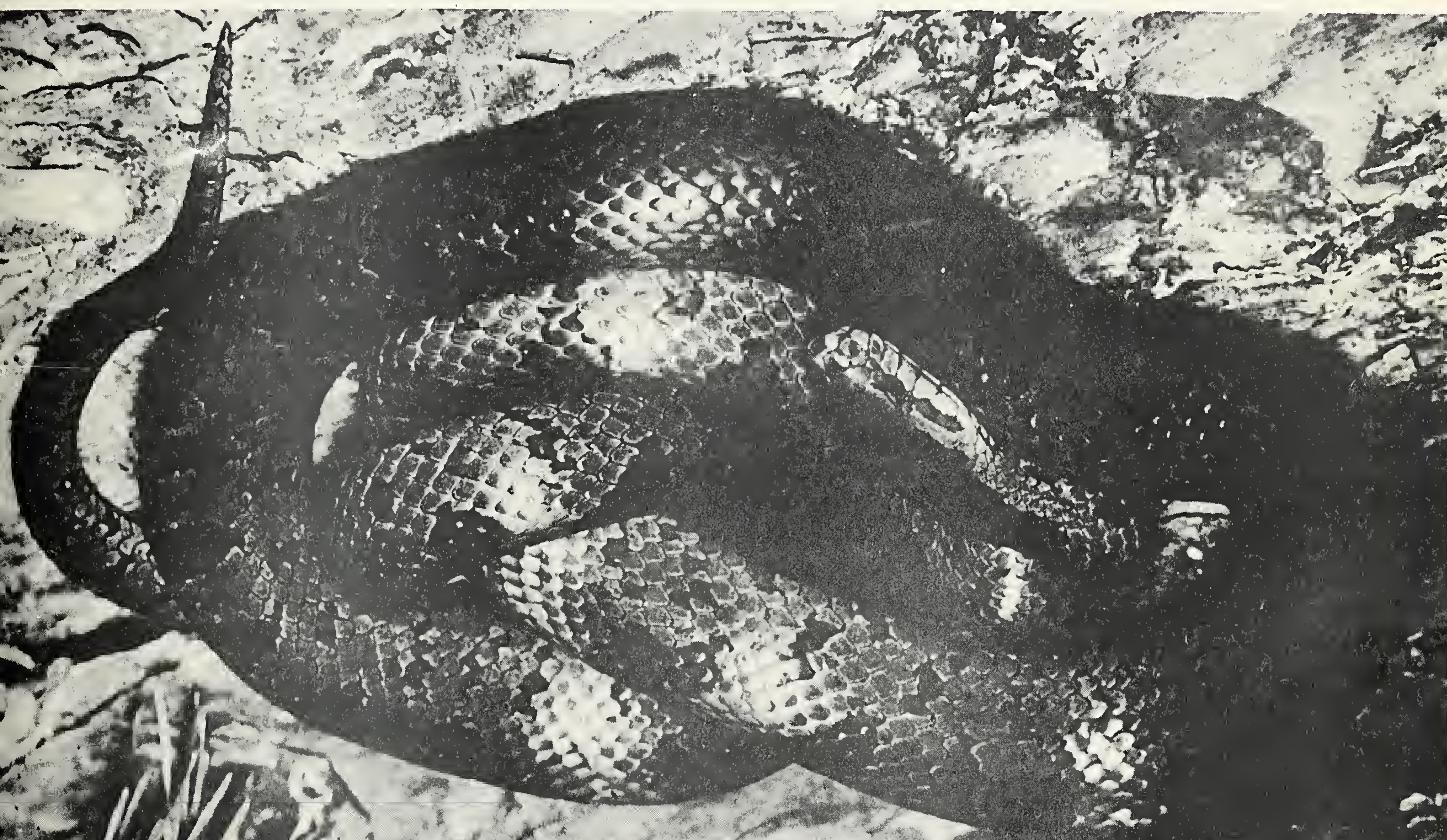
BULLETIN OF THE

Maryland Herpetological Society

The Natural History Society of Maryland, Inc.



MARCH 1969 VOLUME 5, NUMBER 1

Bulletin of the Maryland Herpetological Society
Volume 5 Number 1 March 1969

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The Cover: A *Lampropeltis c. rhombomaculata* from nr. Odenton, Anne Arundel Co., Maryland. Photograph by Dr. Robert S. Simmons.

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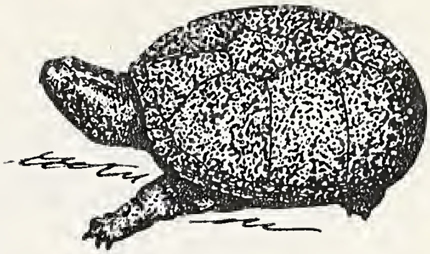

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The Maryland Herpetological Society
Department of Herpetology, Natural History Society of Maryland, Inc.

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Volume 5 Number 1 March 1968

THE HISTORY OF THE HERPETOLOGICAL SECTION OF THE SENCKENBERG NATURAL HISTORY MUSEUM AND RESEARCH INSTITUTE IN FRANKFURT A. M. (INCLUDING A LIST OF TYPES IN THE MUSEUM).

Robert Mertens[1]
Translated from the German by Rozella B. Smith and Hobart M. Smith.[2]

In the older zoological or natural history museums, no distinction was made between the exhibit collection and the research collection. There was only a "collection", open to the general public. Not until around the turn of the century was a distinction made between the two kinds of collections in most of the larger museums, that is, in those that had the status of research institutions. The exhibit can be visited by everyone, the research collection only by the scientist. Thus the two collections have quite different functions. The zoological exhibit serves popular education. It has to be arranged, therefore, in a clear, attractive form, to impart scientific information about the animal to the museum visitor and for this purpose must be content with the display of a negligible number of kinds of animals, represented often only by a single specimen. On the contrary, a research collection represents a scientific archive in which the animals or their parts are systematically collected, as many as possible of as many kinds as possible and arranged according to definite rules and, above all, to be at the disposal of the scientist.

Certainly there are prominent scientists among the zoologists whose scientific research does not, after all, require a collection; their problems are tied up with a few kinds of animals and their life work can even be monumental without their consideration of the diversity of living creatures. This category of scientist has, to be sure, mostly no appreciation for an extensive scientific collection with its wealth of genera, species, subspecies and variants, and with its large series of specimens from all parts of the earth. There are even

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1. Mertens, Robert. 1967. Die herpetologische Sektion des Natur-Museums and Forschungs-Institutes Senckenberg in Frankfurt a. M. nebst einem Verzeichnis ihrer Typen. *Senckenbergiana Biologica*, 48: 1-106, figs. 1-12.

2. We are much indebted to Dr. Mertens for authorization of an English translation, and for his and Miss Erika Schirner's careful editing of it. A few minor rectifications of the original text have been introduced by Dr. Mertens. Except as explained in the discussion of the section entitled "List of Types," the entire original text and illustrations appear here in translation. *Contribution from the Department of Zoology and Museum of Natural History, University of Illinois, Urbana, Illinois, and from (present address) Department of Biology, University of Colorado, Boulder, Colorado.*

scientists with a sense of form an a certain awareness of form who now and then regard a collection as nothing more than a heap of material and react to it as something decidedly boring. The author does not share this attitude at all but is wholly of another opinion: in the consideration of a collection and the animal groups it may contain, he always finds satisfaction insofar as the collection in question is arranged according to a scientific point of view, well ordered and stored in a practical, attractive setting. Such a collection is always the expression of the miraculous multiplicity in which life on our planet expresses itself, the investigation of whose origin represents the basic problem of biology. A true collector is at the same time always an investigator. In the collection that is arranged or administered by him, in which the specimens are identified and cataloged in an orderly way, in which there is a permanent inflow of new material, and in which the gaps are systematically filled, a tremendous amount of intellectual work can be done in the course of a couple of generations. To work in such a collection and to make full use of its treasures for the purpose of research is always a joy for the investigator. There is reflected therein not only the historical development of a given branch of knowledge, but connections to the most varied disciplines can come out of such a collection: above all to taxonomy and through this to morphology and evolution and also to zoogeography and ecology, and even under some circumstances to other realms of science. To what extent this proves to be the case for the herpetological collection of the Senckenberg Museum, whose historical development in the past 150 years is described in the following, the reader may decide.

I. THE EARLY PERIOD (1821-1875).

When the *Senckenbergische Naturforschende Gesellschaft*, through the cooperative activity of Dr. Philipp Jakob Cretzschmar (1786-1845) was founded on November 22, 1817, its aim was the establishment of a complete collection of natural history specimens which by the institute founded by Dr. Johann Christian Senckenberg should become expanded. This "Nature Museum", as Goethe called it, or *Museum Senckenbergianum*, as it was officially called in the preceding century, was opened in 1821, on the anniversary of the founding of the society. But long before this, Cretzschmar had made plans as to whom the future collections, among them the herpetological collection, should be entrusted. So he mentioned in his report of September 1817 (published in 1918) to the Senckengerg Institute Adminsitration, men who as nature-lovers were ready to become co-workers and to enrich the collection with gifts of natural history specimens. In the case of the amphibians (which corresponding to the current concept were not separated from the reptiles and also were desginated by the latter name). Dr. Stiebel offered to take over the amphibians and to contribute his personal collection to this end. However, Salomo Friedrich Stiebel (1792-1868),

a versatile doctor and later founder of the distinguished Stiebel Prize, was not outstanding as a curator of Senckenberg's young herpetological collection. It was rather Carl H. G. von Heyden (1793-1866), at that time a first lieutenant, later senator and *Burgenmeister* of the free city of Frankfurt, also a prominent entomologist, who was first to work with the reptile and amphibian collection in a systematic manner.

Around this time, in August 1822, no less than Blasius Merrem, the author of the significant work, *Versuch eines Systems der Amphibien*, was appointed corresponding member of the Society and offered to identify questionable amphibians in the collection. It is true that the herpetological collection in the year-old museum must have been small, but nevertheless the collection was worth identifying. In his speech of May 1, 1823, J. M. Mappes, the hard working, unusually industrious secretary of the Society, remarked that the collection of amphibians could not be called significant but that nevertheless it contained much that was worthy of note. He said, "A local merchant, J. G. Mappes, presented the Society with several amphibians, also fishes and molluscs, among them rare species. Not for some time was a definite cabinet made ready in the gallery for the collection, since the budget did not permit it earlier and therefore the arrangement could not be called a permanent scientific one." Naturally only a few specimens from this period are preserved in the present herpetological collection. Von Heyden's interest in reptiles stemmed from his interest in the snakes occuring in the outlying areas around Frankfurt. By 1817 he succeeded in proving that it was the warmth-loving *Elaphe longissima* ("Aeskulapnatter") whose frequent appearance in Schlangenbad in Taunus had given the anme to this place. Only two years later Heyden was able to provide the equally remarkable proof that the southeast European *Natrix tessellata* ("Wurfelnatter") occurred in the Lahn River, Bad Ems. In the minutes of the Senckenberg Society of May 5, 1824, there is the remark that Heyden spoke about the snakes of the local area, wherein he surely went into more detail about his significant discovery. Unfortunately he did not publish this information until later (1860 and 1862) and thus the priority for the discovery was yeilded to others. Heyden'a occupation with snakes increased, for in the minutes of the meeting of January 12, 1825, it was noted that he reported on two species of snakes recognized by him as new. Although he had established scientific names for them he likewise neglected to publish them. Even if Mappes could mention in his annual report on May 1, 1825, that the amphibian collection showed no very great increase, those at hand were still unseful since an outstanding investigator of these as in several other branches of natural history, Herr Lieutenant von Heyden, had investigated, identified, and labelled the animals at ahnd with his acute and exact observations whereby he did not neglect to ascertain and write down the important scale counts.

Only when collections from overseas arrived in the Museum did Heyden's studies in herpetology reach results to be published. At this time, foreign material came into the collections sparsely. Aside from the Brasilian shipment of Georg Wilhelm Freyreiss (1789-1825) who died at an early age, it was, at the time, above all Eduard

Ruppell, who most generously donated to the Senckenberg Museum the gains, astonishing for that time, of his trip (1822-1827) into north-eastern Africa, the Sinai peninsula and the coasts of the Red Sea. Shortly before his departure for Egypt, Ruppell sent to the museum, just before its opening, 3 male and 3 female living Greek land turtles (*Testudo graeca*), two still extant. Moreover there exist today in the collection two half grown specimens of *Caretta c. caretta* sent by Ruppell somewhat later as dry preparations from the Mediterranean. These four turtles from the years 1820-1822 are the oldest preparations now in the herpetological collection. No other scientifically valuable reptiles came to Frankfurt until after Ruppell had travelled in the same year in Africa and along the coasts of the Red Sea. The collection as then assembled, inddded did not contain many reptiles but it did contain some new species whose scientific evaluation was taken over by Heyden. This resulted in the well-known Ruppell Atlas (the first publication of the Senckenberg Natural History Society) the herpetological portions of which appeared in the years 1827-1830. Heyden dealt with the new species, nine lizards and one toad, very carefully in a work of six plates and twenty four folio pages and thus secured the first herpetological types for the museum. Even if many of them fell into synonymy, nevertheless there are still some remarkable species among them that were then made known to science for the first time: for example, the dainty gecko *Stenodactylus* (now *Gymnodactylus*) *scaber*, the beautiful Sinai Agama, *Agama sinaita* and *Uromastyx ornatus* ("Schmuck-Dornschwanz").

With this publication, Heyden's activity as curator of the herpetological collection came to an end. He now followed his inclination and turned to the study of insects. Adolph Reuss (1804-1878), a doctor of medicine, took his place with the "amphibians". On Ruppell's proposal he became an actual member of the Society on August 17, 1829. Reuss must have developed an equally industrious as varied activity, for only a few weeks after his acceptance as a member he presented the society with a list of specimens in the fish collection and two years later he had worked out a catalog of the amphibian and reptile collection. This catalog has not been preserved. Not content with this achievement in the herpetological field, in the years 1833 and 1834 he described several new species of lizards, snakes, and frogs. This came partly from that portion of Ruppell's collection that had not been worked on, as for example, *Agama pallida*, *Lacerta* (now *Latastia*) *longicaudata*, *Euprepis* (now *Mabuya*) *septemtaeniatus*, *Coluber nummifer*, *Coluber* (now *Malpolon*) *moilensis* and *Bufo regularis*. Part of it, however, came from other foreign collections.

By 1827 the museum had received reptiles from Batavia (from Dr. Peitsch) among which Reuss described *Brachyorrhos* (now *Enhydris*) *alternans* and *Coluber lippus* (now *Natrix piscator*); in 1832 from Mexico (from F. A. Dillenburger) *Coluber eques*, now *Thamnophis*; and from Brazil whence several specimens were added by the Koch brothers from Ilheas in Bahia in the years 1830-1835 to the old collection of Freyeiss. Among these also Reuss thought that he had found new species. That Reuss had been mistaken in the identification of some species and enlarged the lists of synonymies is understandable because

of the paucity of material available for comparison in that period. His types are still preserved with the exception of *Hyla capistrata*.

In addition to his herpetological writings, Reuss worked on crustaceans and moreover published a treatise on spiders. When he left the Senckenberg Museum in 1834 and migrated to the United States of America, Mappes rightly said, "We suffer an unbearable loss in the departure of our cherished, tireless and many-sided colleague whom we thank for the systematic classification and cataloging of several divisions of the collection, the fishes, amphibians and crustaceans . . . Dr. A. Reuss will step out of our circle." Across the ocean, Reuss joined Dr. Johann George Englemann, formerly of Frankfurt, then living in St. Louis, and who also was interested in the growth of the Senckenberg collection. Later the two together sent many animals from the United States to Frankfurt where the herpetofauna of North America was at the time sparsely represented. The notation on many specimens, "Gift of Reuss and Engelmann" is yet today a reminder of the magnanimous activity of these two collectors.

After Karl W. E. Gerlach, whose productivity was small and whose activity was directed chiefly to fishes, there stepped into the place of Reuss as curator of the herpetological collection a man who made by far the greatest contribution, in the last century, influential even today in the scientific reputation of *Senckenbergianum*. This man, who through his ideals and material achievements, overshadowed all other Senckenbergian scientists was spoken of as the "travelling scientist", Eduard Ruppell (1794-1884). Indeed he applied himself to herpetology only incidentally, but such an experienced scientist, traveller and collector as Ruppell, with his universality of intellectual interest, could not allow the reptiles and amphibians to remain observed. From his second great expedition that led him (1831-1834) to northeastern Africa and also to Abyssinia - he returned to Frankfurt after Reuss had already migrated to the New World. The scientific investigation of his magnificent collection of vertebrates this time he did not relegate to others, but undertook himself. He also took over the curatorship of the corresponding collection in the *Senckenbergianum*. The rich fruit of this investigation is found in the well-known work of Ruppell's appearing in the years 1835-1840 in 322 folio pages and 95 color plates, "New Vertebrates belonging to the Fauna of Abyssinia".

In this, herpetology occupied the smallest part, no more than 18 pages and 6 tables. It was remarkable that in this collection of Ruppell there were no amphibians, crocodiles or snakes. It is therefore very probable that it was these very groups, together with other reptiles, that were carried as freight on board the Russian ship Archip Dimidoff that had sunk in the canal between Le Havre and Boulogne. Among the species described by Ruppell whose types even today embellish the collection are: a new gecko genus and species, *Pristurus flavipunctatus*; another gecko, *Hemidactylus flaviviridis*, and beautifully colored Agamas such as *Agama flavimaculata* and *Agama cyanogaster* (described respectively as *Trapelus* and *Stellio*). The

sea turtle, *Caretta bissa* from the Red Sea named by Ruppell in the same work, proved later to be a valid name for the Indo-Pacific race *Eretmochelys imbricata bissa*.

The catalog of the herpetological collection of *Senckenbergianum*, ready for publication in August 1843 and appearing in 1845 was most important in the activity of the museum. While Oken, in 1844, found 351 species of "Batrachians" in *Senckenbergianum*, Ruppell's list (which formed the 3d section of the Museum's collection) included 370 species on 24 pages: turtles, lizards (in which group Ruppell included the crocodiles), snakes caecilians (represented only by a single species, *Caecilia annulata*), frogs and salamanders. The last three groups he considered to be Gymnoderma, the 4th order of "Amphibians". For the systematic division of turtles and lizards, Ruppell used as an authority the famous work of Dumeril and Bibron, *Erpetologie Generale*. Since the snakes had not yet appeared in this work, he used, as an authority to identify species, Schlegel's *Essai sur les Serpents*. For the 4th order ("Nackthautige Amphibien"), Tschudi's classical work on the classification of amphibians was used as a guide. Ruppell had labelled all specimens very carefully. Each was designated by alpha-numeric symbols consisting of two numerals and two letters of the alphabet: first a Roman numeral designating the order, second a capital letter corresponding to the genus, third an Arabic number for the species and fourth a small letter of the alphabet for the individual specimen. In the footnotes he made many explanatory or critical remarks. Unfortunately he listed many "nomis nuda" but he did describe, however, two new species, *Chamaeleo affinis* from Abyssinia and *Atropos nummifer*, (now *Bothrops*) of unknown origin. It can be seen in this catalog that around this time the collection already contained many specimens from outside of Europe that had been donated by various patrons. The greatest growth of the collection was due to the efforts of Ruppell himself who had given many of his duplicates in exchange to other collections. Of the 370 species mentioned in the catalog, not less than 169 (45.7 percent) came to the museum through Ruppell's collecting and in his activity in exchange of specimens. Further, thanks to Ruppell's scientific reputation, many specimens were sent to the museum by famous donors, as for example two North American *Kinosternon s. subrubrum* from Prince Charles Lucien Bonaparte in the year 1825 (SMF 32957-8). Two years after the appearance of this list Ruppell was appointed "Sektionar", that is, honorary curator of the collection for reptiles and batrachians, also for fishes and mammals and in 1850 for crustaceans as well. It was at this time that several foreign investigators made reference to Ruppell and the Senckenberg collection, among them Jan who was at the time busy preparing his monumental work on snakes. Jan had established his Australian *Alecto* (now *Hoplocephalus*) *bitorquata* with the use of this material. Ruppell did not put aside the position of curator of herpetology until the end of 1862. The situation that caused him to take this step need not be discussed here. It is enough to allude to the fact that in spite of a certain coolness that had entered into his relationship with the Society, he was loyal to the collection which at this time was growing slowly. Thus in 1863 he demonstrated the necessity to keep the herpetological

collection out of the sun since daylight promotes fading of the preparations. Ruppell therefore suggested that the collection be placed in narrow cupboards along the wall, protected from the light, and proposed the sum of 250 fl. for the preparation of the new amphibian cabinets. A few years before his death Ruppell again became a curator, not for lower vertebrates but for birds and mammals.

A significant standstill in the development of the herpetological collection was seen in the period after 1860. Dr. Jakob Hermann Bockenheimer (1837-1908), later a well-known local commissioner of sanitation (his monument stands in the Oppenheimer Square), then was accepted as a member into the Society and was appointed 1865 as honorary curator of the amphibian and fish collection that had been neglected for three years. As one of the herpetological outsiders he was able to effect no progress. Yet it is worth mentioning that in these years reptiles from Australia, rare in the collection, were added. The Society bought a number of amphibians, fishes and insects of New Holland for 100 fl. from Adam Becker who was a servant of the Society at that time. Not much more progress was made in the collection under Bockenheimer's successor, Dr. Valentin Mardner (1838-1871) who was admitted to membership in the Society in 1868, then became its first secretary and finally was appointed curator of fish and amphibians. Mardner was no scientific investigator even if he did occupy himself in the field of zoology mostly with reptiles and amphibians. He published nothing, being no friend of the modern "Schreibseligkeit". In 1870, shortly before Mardner's untimely death, Emil Buck (1840-1899) who showed promise of giving the curator strong support began to work in the herpetological collection. Buck took over the section after Mardner's death and acted in addition as secretary for the Society until 1874. In 1875 he went to Zurich and there, two years later, received his Ph.D. with a dissertation on Rhizopods. He did not return to Frankfurt but then went to Constance where he remained until his death. With great thoroughness he applied himself to the study of lower fresh-water animals as well as to aquaria and terraria. In the field of herpetology he published a series of popular articles on local species. The quiet influence of this talented scholar has been described by Kinkelin and Boettger (1901).

II. OSKAR BOETTGER AND HIS SUCCESSORS (1875-1920).

The state of inactivity that the herpetological collection fell into after the departure of Ruppell as a responsible curator, came to an end happily in 1875 when this duty was taken over by a man, at first only incidentally, who in the three and a half decades of his influence brought the amphibian and reptile collection to a level once achieved by Ruppell for the whole Senckenberg Museum.

This man, who founded the world-wide reputation of the herpetological collection and who can be regarded without exaggeration as its creator, came from paleontology. He was Oskar Boettger. Born March 31, 1844, he was the oldest son of the great chemist Prof. Dr. Rudolph Boettger, the discover of gun-cotton, collodion and the phosphorous-free match. In the Gymnasium of Frankfurt, his home town, he received

the certificate required for entrance into the university in 1863. Already as a boy in the 6th form, he had established relations with the Senckenberg Society where he received his first inspiration in the geological and palaeontological lectures of Dr. Otto Volger who at the time was an instructor of the Senckenberg Natural History Society and later founder of the Freies Deutches Hochstift. He was destined to study at the school of mines in Freiberg (Saxony) in order to become a mining and metallurgical engineer. In the politically disturbed year of 1866 he left the school of mines with a diploma, but because of the upheaval there, he was unable to find a corresponding position to continue his education. He turned to teaching in 1869 received a Ph.D. from the University of Wurzburg with a thesis, "Contributions to the palaeontological knowledge of the tertiary formations in Hessia". In Giessen he passed the prescribed examination to teach in the gymnasium and in the secondary school. A year later, after teaching descriptive natural history a short time in the Offenbach secondary school, he received a position in the Frankfurt Muster-Schule. While he was a student, Boettger made a complete collection of tertiary gastropods and lamellibranchs (both terrestrial and marine) of the Mainz Basin for the Senckenberg Museum, a collection of invertebrates that had not been represented in the museum before this time. In the year 1870, thus soon after his promotion he was appointed honorary curator of the palaeontological collection. The herpetological collection, neglected in Buck's time, which was cared for in 1875 by Boettger only incidentally -- as it was reported in the Bericht der Senckenbergischen Gesellschaft (1876) -- he is said to have curated for 35 years until his death in 1910. If one considers that Boettger did not leave his house because of a nervous disorder, agoraphobia (Platzangst), that is really an astonishing achievement.

This unfortunate condition lasted from June 11, 1876 to August 14, 1894. Had it not been for outsiders he might have led a barren, unhappy life. Actually Boettger's intellectual activity reached its highest point in this period. Of his 325 scientific works, not less than three quarters were produced during the long years of his confinement. The story of his return to public life is known. As a painstaking stamp collector, Boettger left his house one evening in order to obtain an 1893 five dollar American anniversary issue that he did not have. His nephew had promised to give it to him if he would come after it himself. Boettger obtained his stamp. The spell was broken and his sudden recovery permitted him not only to go through with some trips abroad, but even to resume his teaching which had been interrupted for so long. Boettger was, according to his friend Kobelt, a teacher "von Gottes Gnaden" and was able to work effectively in a secondary school for another 12 years until a year before his death on September 25, 1910. He was originally a palaeontologist and had published more than 50 works in this field, mostly malacological. From 1869 on he was interested in modern reptiles and amphibians and from 1877 on, in modern Mollusca, among them especially the family *Clausilia*. His first herpetological work had to do with a collection from Spain and Portugal made by Lucas von Heyden, the son of Senator von Heyden mentioned earlier. It appeared in the *Bericht des Offenbacher*

Vereins fur Naturkunde (10:50-59, 1 plate) in 1869. In this he described his first new taxon *Coronella laevis* var. *hispanica*. After a short interruption a continuous stream of herpetological publications, with many new descriptions, flowed from Boettger's pen that only began to dry up around the turn of the century. Kinkelin cited not less than 127 publications by Boettger in the field of herpetology, among which much of importance is found. Especially noteworthy are his annual detailed reports on the herpetological publications for the years 1882-1892 in *Archiv fur Naturgeschichte* and later the many references in the *Zoologisches Zentralblatt* (1894-1902). Not until three years after Boettger's death did his work appear (not considered by Kinkelin) on the reptiles and amphibians collected by Voeltzkow, chiefly in Madagascar and the neighboring islands (in: Voeltzkow, Reise Ostafr. 3: 269-375, plates 23-30, 1 Abt., 1913). Boettger's name became known in wider circles through his excellent work appearing in *Brehms Tierleben* (1893) in the third volume, "Kriechtiere und Lurche", as well as his continuous contributions to the journal *Der Zoologische Garten* (1869-1910).

In his scientific work Boettger's preference for pure *faunistic* catalogs is clearly evident, based understandable on a most careful taxonomic evaluation of material. For genetic-zoogeographical problems he had, at least from a herpetological standpoint, little interest, also ecological questions interested him only by way of exception in spite of his profound knowledge. In contrast to his malacological works the major taxa formed no base for herpetological publications and there emerged from his pen no revisions of genera, families or other systematic categories. On the other hand he submitted surveys of the herpetofauna of entire areas in full. He occupied himself with the Mediterranean lands, especially with the herpetofauna of Northwest Africa and the Iberian peninsula; with Sicily, Greece, Asia Minor, the Caucasus and the Transcaspian. In addition he was also fascinated by the herpetofauna of China, the Phillipines and the entire Sunda-Archipelago and equally by that of Southwest Africa, the lower Congo and Madagascar with its neighboring islands. Regarding material from the New World he published on reptiles and amphibians from Brazil, Paraguay, Peru, Venezuela, Ecuador and Central America. Boettger did not fail to observe, naturally, the local species. It was he who was first to prove the occurrence of the jumping frog, *Rana dalmatia*, on what was then German soil, namely in 1880 in Strassburg in Elsass. It was also Boettger who was the first to call attention to the difference between the middle European *Hyla arborea* and its west Mediterranean cousin which he described as *Hyla arborea* var. *meridionalis* in 1874 and which is today regarded as perhaps an independent species. It is understandable that the determination of material from parts of the world little known at that time revealed many species and even genera previously unknown to science. Especially in this connection Boettger enjoyed a rich success. Not less than 229 types of Boettger's new species and varieties, selected mostly out of the syntypes, were later added to the Senckenberg collection where they remain, fortunately, as good as ever until the present day. In foreign museums, on the contrary, Boettger's amphibian and reptile types are seldom

found. Even though many of Boettger's names have been recognized in the meantime as synonyms, 70 percent of them are considered to be valid today. Many of his species have become subspecies. Most of his types in Senckenberg are lizards (92), followed by anurans (69) and then snakes (63). There are only two turtles and caecilians in the type collection and only a single type of salamander. By far the greatest number of types (74) come from Madagascar and the neighboring islands, whereas 43 types are from Africa, including its Mediterranean coasts. Collections out of the Indo-Australian archipelago, including New Guinea and the Philippines provided 41 types, Asia 35. The New World provided Boettger with 30 types, and our continent on the contrary with 4 and Australia no more than 2. All in all Boettger established 20 genera and it is significant that nearly all of his generic names are in use today and are familiar to all herpetologists, for example among the anurans *Cophixalus*, *Oreophryne*, *Rhombophryne*, *Stumpffia*, among lizards *Blaesodactylus*, *Crossobamon*, *Ebenavia*, *Micrablepharus*, *Quedenfeldtia*, *Voeltzkowia*, among snakes *Calamorhabdium*, *Hemirhagerrhis*, *Heteroliodon*, *Micrelaps*, *Pararhadinaea*, *Tetralepis*. How did it happen that Boettger, during his long confinement, continually received new material that made possible such a scientific contribution? It came through his own contacts: in the main from his numerous friends, as well as from his students who collected for him in all parts of the world and with whom he maintained a constant correspondence. There must have been around 200 correspondents -- they are all named in Boettger's catalogs -- from whom he received welcome gifts from the outside world, among them such well-known scientists as J. von Bedriaga, G. A. Boulenger, P. Hesse, H. von Ihering, O. von Moellendorff, E. Schreiber, V. L. de Seoane, F. Werner, W. Wolterstorff and many others. Yet great collections of travelling scientists, for example Kukenthal in Borneo and the Moluccas; Semon in Australia and New Guinea; and Voeltzkow in Madagascar, came in occasionally at that time. Boettger received many specimens through exchange since many valuable duplicates were at his disposal. He could only obtain a few through purchase because of the paucity of museum funds. Finally many valuable specimens made their way after their death from the steadily growing Zoological Garden to his home. There the scientist sat in the ground floor of a garden house "surrounded by thick clouds of tobacco smoke, a long pipe in his mouth, at a desk on which a beautiful tomcat reclined. All kinds of living animals, canaries, hylids and geckos were his roommates. Before him towered boxes and caskets of snails,and jars of snakes, lizards salamanders, and frogs from all major countries. And nearby lay a heap of letters and postcards from his scientist correspondents wtih rare foreign stamps the sight of which filled the hearts of his visiting fromer students with delight and envy." (Kobelt 1911: 79). Boettger reported in great detail each year to the Senckenberg Natural History Scoiety on the entire, even the most insignificant, herpetological acquisitions (see the *Berichte* of this organization particularly in the years 1885-1909). The fact should not be overlooked that in Boettger's whole scientific work as well as in his mechanical work of collecting he was literally chained to his desk as a result of his illness. From this desk he increased the herpetological treasure of the museum and put it in order. He identified and described the specimens and even produced a complete, three-volume catalog of the

collection as it was at the time. His friend Kobelt said of this "[it was] as eloquent a testimonial of his sense of order as for his gigantic memory that when he finally returned to the museum he knew the exact location where he could put his hand on each one of the many thousands of jars of specimens that had been carried back and forth between his house and the museum in his years of seclusion." Meanwhile in the museum the collections of the "conservatory" was in the care of the so-called "conservators", first Theodor Erckel, Ruppell's travelling companion in Abyssinia, then Adam Koch and finally August Koch. The letter, who worked with me for over 20 years, told me that the daily transport of jars to Boettger's home from the museum and back was often not interrupted for weeks on end. Boettger's accomplishment can only be appreciated by another herpetologist who knows how much time and how much comparison of specimens is necessary in order to identify an animal positively. Both of the first two of the catalogs that have been mentioned appeared during Boettger's illness. The first included the amphibians (1892) and the second the reptiles with exception of the snakes (1893). Boettger listed (on x + 73 and x + 140 pages respectively) 284 species of amphibians at hand at this time in the Senckenberg Museum; 568 species of reptiles, with exception of the snakes, 1702 and 2885 specimens respectively. Five years later when Boettger was well again the third catalog came out, dealing with the snakes. This included 584 species (of 2837 specimens) on ix + 160 pages. The herpetological collection contained by this time 1436 species and had, since the publication of Ruppell's catalog (1845), that contained only 370 species, increased almost 4 times, thanks mainly to the unceasing activity of Boettger. As manuscripts for these 3 catalogs there was the handwritten catalog: three thick quarto volumes on the pages of which Boettger had written in his attractive, easily legible hand. These three catalogs were carried on, in spite of inadequacies inherent in the times, by Boettger's successors until the year 1920. The British Museum's monumental catalog of G. A. Boulenger served Boettger as an authority for his catalogs. In these 9 volumes (1882-1896) which included all of the species of amphibians and reptiles known at the time, Boettger saw the indestructible structure of a neoherpetological system represented, which scarcely could be shaken and at the most supported by a few foundation stones or embellishments here and there. It is no wonder that Boettger followed this catalog carefully in the general arrangement of the higher systematic groups and in the sequence of families, genera, species and varieties as well as in scientific nomenclature. Further he had even taken as a basis the volume and page numbers of the English catalog for the numbering of the collection jars in his own catalogs. He went about this in the following way: each jar that contained one or more specimens from the same locality and collected by the same collector received a number, a four part number, whose first cipher represented one of the nine volumes of Boulenger's catalog whereby the series began with the Salientia (= 1) and closed with the third volume of the snakes (=9). The next three ciphers were based on the page numbers in the corresponding catalog of Boulenger's. In this manner each species received a number which made possible by an easy reference to the Boulenger catalog. Since however, Boulenger had treated two or more species on the same page, the

second or third species was designated by a 1 or a 2 set off by a comma. The number 7025 designates for example, *Typhlops muelleri*: 7025,1 on the other hand stands for *Typhlops madagascariensis*: both are on page 25 of the 7th volume (the first volume of snakes). If a new species turned up that was not in Boulenger's catalog it was inserted into the system in its place and designated by a continuing number following the comma. In addition, each jar with identical content received small letters in alphabetical sequence behind the number. Thereby the specimens brought together in a jar were not taken into account so that the individuals, insofar as several were found in one jar, were not individually designated. Boettger wrote the same numbers on small permanent pieces of paper and put one into each jar, and pasted one onto each stopper. "This arrangement has the great advantage that it gives us a number, if for example the label should be lsot, that tells us the correct name of the animal and at the same time the page number of the British Museum catalog and the code number of our own catalog where we immediately can refer to details concerning the questionable species." (Boettger, 1892: ix) Boettger gave us great care to the labelling of the specimens of the collection as he gave to their numbering. On the labels which were pasted on the glass under the cover with a very permanent paste, the scientific name was written legible with a statement of the author: below to the left the exact locality where the specimen was found, and to the right the name and place of the collector or donor along with the date. Under the scientific name came the literature citation which designated not as one would expect the original description but again that of the catalog of the British Museum, indispensible to Boettger. For greater clarity the labels were given colored borders. The black edged labels were used for animals form the Palearctic region, blue for Ethiopia, yellow for the Orient, green for Australia, rose for Nearctic animals and red for Neotropical animals. In this manner, throughout the collection -- and at this time there was only an exhibit collection -- an accurate insight into the geographical spread of each species was made easily possible. Since Boettger himself could not use the collection in the museum for many years, but was dependent on the help of non-professionals, the colored labels made it easy for the non-specialist to seek out what was desired. By 1881 Boettger had written a short set of instructions on the collection and preservation of reptiles and amphibians. The collection consisted at that time as it does today mostly of alcohol preparations. Only a few specimens, mostly turtles and crocodiles and the large lizards and snakes, were mounted as dry preparations and stuffed in the old way. Osteological preparations in this period are scarcely worth mentioning. One could be astonished that the number of specimens in Boettger's catalogs was so small according to modern ideas. By the time that the catalog was printed there were altogether not more than 7404. This very modest number can be explained by the fact that Boettger did not pay much attention to individual variation of reptiles and amphibians and therefore did not include large series from the same locality in the collection but on the other hand satisfied himself as a rule with just a few specimens. The remainder were put into large jars and served as duplicates for exchange.

Oskar Boettger was Germany's leading herpetologist in the last decades of the last century and at the turn of the century and it can be said that he was also the leading malacologist. This is reflected in the many scientific names dedicated to him. When he died in the fall of 1910 he not only left a significant scientific collection, definitely separated from the exhibit collection in the Senckenberg Museum, which was moved in 1907 into its new building in the former Viktoria-Allee (now Senckenberg-Anlage); but more important he left to the Senckenberg Society the responsibility of taking care of this collection and building it up. Boettger busied himself with the collection as had all of his predecessors, in an honorary capacity while he administered it as curator. Since after his death no qualified person could be found to serve in an honorary capacity the Senckenberg Society considered it to be their duty to make a definite position for an assistant, in view of the importance of the collection and the need for care and evaluation of rich acquisitions, for example from the expeditions of H. Merton to the Aru and Kei Islands and of J. Elbert to the Lesser Sunda Islands.

Moreover, the concept of curator had changed since the turn of the century. The earlier men, mostly teachers and medical men, were capable, thanks to their scientific inclinations and affluence, of not only caring for but scientifically evaluating a collection. It became increasingly clear, considering the advance of knowledge, the enormous growth of literature and the constantly increasing multiplicity of problems that a research collection could only be cared for with success by an employed scientist. On the other hand it was not desirable to give up the curatorship in the old sense while the collection was developing, above all while it was being increased by gifts. Therefore in the year 1911, two of Frankfurt's highly cultured men were named curators: Prof. Dr. August Knoblauch (1863-1919) for amphibians and Dr. Kurt Priemel (1880-1959) for reptiles. The unforgettable Knoblauch "for twenty years the soul of the Senckenberg Society" (Strasses 1919: 4) was an enghusiastic observer and cultivator of newts and salamanders and moreover had published many informative contributions on *Mertensiella caucasica*, but on the other hand the influence of this many-sided doctor on the amphibian collection remained meager. Also Priemel, from 1908 to 1938 the successful director of the Frankfurt Zoological Gardens, was hardly outstanding as curator of the reptile collection. Nevertheless he is to be thanked for several beautiful gifts from the zoo. The war forced him to give up the position of curator by 1915 (mertens 1959: 139) while Knoblauch remained in his position until his death. After that no other curator was appointed for the herpetological collection.

Who was to be considered after the death of Boettger for the newly created position of professional herpetologist who at the same time should also take care of the ichthyology collection for Senckenbergianum? The attempt to get Lorenz Muller (1868-1953), at this time at the peak of his activity did not succeed. At the beginning of December 1910, Philipp Lehrs, a gifted reptile student, entered into the service of *Senckenbergianum* as scientific assistant. Born in

Breslau, August 9, 1881, he received his Ph.D. under Haeckel in Jena February 29, 1908. The topic of his thesis was, "Studies on the Evolution and Distribution of the Groups of the Genus *Lacerta* and their Relatives." He applied himself in the Senckenberg Museum at first to the preparation for publication of a large work from the legacy of Boettger, on the collection of Voeltzkow. In 1911 with extensive support of the Senckenberg Society he led a herpetological expedition to the Adriatic Island Pelagosa and a few other islands. The scientific results of this trip, however, did not come up to the expectations of the museum authorities and were therefore not published. Lehr's appointment as regular herpetological assistant came through on January 1, 1912, but a year and a half later he resigned his position at Senckenberg and moved to London to work in the British Museum. After his release from British internment during World War I, he returned to Germany and spent the remaining years of his life in Munich where he was employed chiefly as an official expert in conservation by the Bavarian government. He did not apply himself to further herpetological problems although he doubtless would have been able to do so because of his knowledge. On April 20, 1956, he died in Munich.

Subsequent to the summer of 1913, therefore, the herpetological section declined. It was jsut at this time that it received a significant increase: an extensive collection of lizards and tree frogs from the Canary Islands which Dr. Caesar R. Boettger (now Professor emeritus) a nephew of Oskar Boettger had collected and presented to the museum. The Senckenberg Society now invited Richard Sternfeld to occupy the vacant position of herpetologist on September 1, 1913. He had already made a name for himself through a series of works on the reptiles of the German colonies of that time. Sternfeld was born in Bielefeld, February 8, 1884, and studied zoology with Weismann in Freiburg where he received his Ph.D. at the end of 1906. The title of his dissertation was "The Atrophy of the Mouthparts and the Change in the Function of the Intestine in the Ephemeridae". He moved to Berlin early in 1907 in order to begin independent research in herpetology at the local zoological museum. In Berlin his work on reptiles and amphibians for the well-known series *Schmeil's Naturwissenschaftliche Atlanten* was begun.

In Frankfurt Sternfeld busied himself first of all with the herpetological yield of the second Inner-Africa Expedition of Duke Adolf Friedrich of Mecklenberg; then with the extensive collection of the Hanseatic South Sea Expedition which the former curator of the Senckenberg Museum, Dr. Eugen Wolf, had accompanied as zoologist; and finally with the reptiles brought together by M. von Leonhardi in Hermannsburg in Central Australis. In these and other small works 43 new descriptions are contained whose types are in the herpetological collection of *Senckenbergianum*. Even if a few of these descriptions rest on an unsure base, nevertheless many others are still valid as for example the lizards described from Australia. Sternfeld was especially fascinated by poisonous snakes: the descriptions of his singular Cameroon *Naja anomala* (now *Paranaja*) and the Venezuelan *Lachesis medusa* (now *Bothrops*), also the interpretation of the poisonous-snake eater "Mussurana" as *Pseudoboa cloelia* (instead of

Rhachidelus brazili) originated in the Senckenberg Museum. He was a good observer and sensitive investigator who, obviously under the influence of Weismann, had devoted several very detailed studies to the mimicry problem in snakes. Toward the end of World War I he was a soldier in Macedonia. After this he was a zoologist in Bialowies. Next to herpetology he was interested in rearing thoroughbred horses, to which interest a publication by order of Arthur von Weinberg is indebted. Unfortunately he had little talent for successful curatorship of a collection or for the steps necessary for preparation and conservation. An unfortunate quarrel with the Museum director in June of 1920 led to the end of his working relationship with *Senckenbergianum* at the end of that year. He stopped herpetological activity completely and soon after the outbreak of the war was employed in a munitions factory in Berlin-Treptow and was arrested as a Jew early in March of 1943. Shortly after this he became an unfortunate sacrifice to the power of National Socialism in an extermination center. A younger fellow-sufferer who escaped death by a lucky accident, to whom Sternfeld had been a fatherly friend, wrote to me about him, "He loved his fatherland, Germany, as does every man of his origin and education, and felt himself to be entirely German."

III. THE LAST DECADES (1921-1967)

After the move of the museum into the new building in 1907, the amphibian and reptile collection was brought together in the upper story of the north wing, whose space was bounded on one side by the ornithological section and on the other by the laboratory. Here, zoological courses were given for students of the young Frankfurt University until 1919. Because of many small windows and the impossibility of darkening the room, the space was little suited to a collection of alcohol preparations. In addition to this, the ichthyological collection which required the same space was also destined to occupy this inadequate room. At the time that I was given authority for the management of the collection on October 1, 1920, as assistant and from 1925 as curator, a chaotic condition reigned in herpetology. Perhaps one third of the jars were not in the cabinets but were standing in disarray on the floor before and behind the cabinets. On these, the dry preparations of turtles and lizards lay all mixed up together and covered with dust. Some of these latter proved to be very valuable.

Before any systematic work with the herpetological collection could be thought of, it had to be brought into order. This was not easy because the few cabinets were so full that there was no place to put anything. Fortunately the lecture hall soon became available because the students were moved into the Zoological Institute of the University. After it was fitted out with cabinets and shelves I was able to bring together the entire fish collection, including the many dry preparations from Ruppell's time, into this room. Into the cabinet space that became available in the original room, only jars that contained herpetological preparations were placed. Also an appreciable part of the dry preparations could be brought together in one place and

arranged that the desired specimens could be found without a great loss of time. During this time great progress was made in the modernization of the exhibit collection of reptiles under the leadership of the director of the museum, Prof. Dr. Otto zur Strasse (1869-1961). This along with a few especially beautiful specimens from the fish collection was made available to the public in July 1924.

Under these conditions I could finally in the summer of 1921 begin scientific work in the herpetological collection. The first thing that was obvious was that the catalogs, constructed so carefully by Boettger, were no longer sufficient for modern demands. As mentioned earlier, they were based on those of the British Museum. Several decades had passed since the appearance of Boettger's catalogs, and during this time the science of herpetology had not only been enriched by countless numbers of new species and genera but had also been altered in many important, purely systematic concepts. It is only necessary to compare the divisions of amphibians or of the genus *Lacerta* in Boulenger with modern concepts. In addition it was necessary to make the names used in the herpetological collection conform to the "International Rules for Zoological Nomenclature". Some of the strange products of nomenclatural procedures of earlier decades, as for example use of *Polypedates* instead of *Rhacophorus*, *Coluber* instead of *Vipera*, and *Crocodylus niloticus* instead of *Paleosuchus trigonatus*, were fortunately reversed again. But, besides this, also an enormous number of names had to be changed that Boettger had taken from Boulenger.

It was the impossibility of forcing the representatives of the genus *Lacerta*, which already were very numerous in the Senckenberg collection, into Boettger's catalog that moved me as the first project of 1921 to put the names on cards and to construct a card catalog. Therefore the old numbering of Boettger in the jars had to be continued because of a new numbering system which referred to each single specimen would have required a work of several years. The duplicate collection of Boettger (inasmuch as accurate locality data was at hand) was broken up and entered into the main collection at this time in consideration of the importance of series. The less worthwhile specimens without data remained in a small collection which was to serve primarily as material for teaching and for anatomical study. The new card catalog was finished on December 1, 1921. At that time the herpetological research collection consisted of 594 genera, 2535 species, 8950 numbers of 21,381 specimens. This was an enormous increase over what had been represented in Boettger's catalog (434 genera, 1436 species, 3863 numbers and 7404 specimens).

As the cards were made, a list of types was also made which appeared in print in 1922. The list included 322 type-specimens described by 15 authors. If the current nomenclatural status of the types was familiar to me at the time, this was given. As far as it was feasible a "Lectotype" was chosen from among the cotypes (now syntypes) and that was put into a jar and marked by the work TYPE on a red label. The function of the new type catalog was expanded not only to complete the old one by the addition of new entries but also to update the nomenclatural status of the lectotypes and to assign to them a valid collection number.

It was very much my responsibility to increase the collection because since the beginning of the war in 1914 nothing worth mentioning had been added. To be sure I had contributed some of my material from Italy and Rumania but nothing had come in from abroad. New expeditions could not be made and the purchase of new specimens for the collection could not, unfortunately, be considered because of lack of funds: for example *Palmatogecko rangei*, *Varanus rudicollis* and even *Walterinnesia aegyptia* were not represented in the collection. However, in the case of this latter impressive poisonous snake I succeeded in obtaining the necessary amount of money,thanks to the friendly help of Fritz Drevermann(1875-1932), to secure a valuable specimen for the collection. If the number of forms, above all of the genera, were to be further increased, nothing remained to be done but to establish an exchange with the larger museums for, at the time, because of Boettger's assiduous industry, a large number of duplicates, even of paratypes, was available. Inquiries made to the great museums were fruitful, and very soon from Munich, Berlin, Vienna, New York, Chicago, San Francisco and Cambridge (Mass.), very beautiful material arrived,which by and by filled out very important gaps in the collection. By way of exchange representatives came to Frankfurt of the turtle genera *Claudius*, *Platysternon*, *Dermatemys*, *Hieremys*; of the lizard genera *Xenosaurus* and *Corucia*, and also *Cricosaura* and other species of the family Xantusiidae, up to then totally lacking, and almost all of the forms of the genus *Tropidurus* from the Galapagos; of snakes, *Loxocemus*, *Erpeton*, *Boulengerina*, the rare *Vipera superciliaris*; of amphibians *Ascaphus*, *Leiopelma*, *Barbourula*, *Anotheca*, etc.

By far the most rewarding efforts for building up the collection as well as for the development of scientific knowledge, it seemed to me, were expeditions for study and collecting abroad. In the same way that I had already travelled in the field (Tunisia 1913, Southern Italy 1914, Rumania 1918), after the stabilization of the economy, I was able to make a small trip early in the year of1925 to Calabria and Sicily. The purpose was to collect various forms of wall lizards. A year later I made another trip with the same purpose not only to Sicily but also to the Pelagian Islands, Pantelleria and Linosa. I spent the greatest part of the year of 1927 as a participant of the Rensch Sunda-Expedition in the Indo-Australian archipelago. We travelled in Java and the island chain lying to the east, little investigated at this time, of Bali, Lombok, Sumbawa, and Flores. With the herpetological material of this trip one could be satisfied. The material was indeed rich; in it were many new forms as well as new records, also two beautiful specimens of the well-known giant lizard of Komodo, *Varanus komodoensis*. The gigantic male was placed in the exhibit collection while the female lived for a long time in the zoological garden and died there during the bombing. In the late summer of 1928, I travelled in Sardinia and Tunisia, especially in the island of Djerba and early in 1930 to Apulien, Calabria and Northeast Sicily. In the years 1932-1936 I went again to Ticino and the islands of Lake Maggior from whence I brought back to Frankfurt large series of lizards and other groups. In the fall of 1934 I was able to make short stops in Lisbon, Tangiers, Tenerife and Madeira, and to obtain several desired reptiles, above all a beautiful

series of *Lacerta dugesii*. I made a very worthwhile collecting trip toward the end of 1937 to Cameroon, where, in the region of the Great Cameroon Mountain, I not only newly rediscovered the gecko *Cnemaspis koehleri* but also acquired a series of living specimens of the peculiar *Trichobatrachus robustus*, the hairy frog. No less rewarding was my last trip to the tropics before the war that I made in 1939 to the West Indian island of Haiti, where I worked most of the time in the German-Dominican Tropical Institute in Cuidad Trujillo, the modern Santo Domingo. As on other trips, I tried to fill the gaps in the herpetological collection. So I succeeded in getting specimens of a giant tree frog (*Hyla vasta*), and published the results of my herpetological studies.

I had been occupied by problems of evolution since the summer of 1914 that I had spent in Positano on the marvellous Gulf of Salerno and from when I visited the Galli Islands as well as the island of Capri. Here I became acquainted with Spadaro, the fisherman, known all over Capri, who captured for me several of the beautiful blueblack lizards, *Lacerta sicula coerulea*, on the steep Faraglioni cliffs. Eimer's ideas about this animal, which had been criticized by Bedriaga, Braun and others, made such an impression on me that I decided to turn my attention not only to the problems of insular spec iation, but especially to the different forms of variability. For this reason I had always tried on my trips to collect as large a series as possible of various ages and both sexes of each species. I had always observed carefully the racial differentiation correlated with geographical variation in speciation. Since such a large series of lizards, snakes or amphibians is often worthless for variability studies of significant characters, if their state of preservation is poor, I had upon taking over the collection, paid attention not only to proper preparation but also to satisfactory preservation. Exactly in this respect many famous collections both at home and abroad often made a very unhappy impression on me and at the time *Senckenbergianum* was no exception. Only in Munich with Lorenz Muller and in Magdeburg with Willy Wolterstorff could very beautiful preparations be seen and the two are my masters in the field of preparation technique. According to our experience, the amphibians are best killed in 4 percent formalin, hardened in it for a few hours, and then preserved in 70 percent alcohol denatured with camphor. The reptiles on the other hand, after being chloroformed, were injected with 96 percent alcohol (to which 5 parts of 40 percent formalin per 100 parts had been added), and then preserved in 70 percent alcohol (large specimens in 75-80 percent alcohol). All of this work I did single handed up to the beginning of the war and not until 1940 did I train Hans Pape, the present preparator who was at that time a trainee, for this work.

The collection made good progress. The addition of new material was considerable and only the cataloging was not satisfactory. I substituted an accession number of Boettger's old and intricate numbering on the jars, whereby the number of individuals found in each bottle was noted, but this accession count, at the time from 1 to around 26,000 was for the most part on paper, that is, in the book

catalog and in the old card catalog that I had prepared in 1921. These now made an antiquated impression because of the many invalid names and the lack of consideration of geographical races so that in 1939 I decided to start a new catalog. Before this project could begin, the important problem had to be solved, in the fall of that year, of protecting the collection from the effects of the war that had just broken out. A large collection consisting of many thousands of jars filled with alcohol could naturally not remain longer in an upper story protected only by a thin roof. Thanks to the initiative of Rudolf Richter (1881-1957), the director of the museum, proper space for it was found and fitted out in the basement of the northwest corner of the museum. The room next to the small lecture room, in which the teaching collection used with lectures was brought together, was made available and in addition to these, three further basement rooms were so adapted that there was space for a number of cupboards and shelves. Into this room in the fall of 1939 the whole herpetological collection was moved and carefully arranged from a systematic point of view.

Now action could be taken on the preparation of the new card catalog, already planned for a long time and now begun with the actual numbering of individuals. This work kept me busy during the first winter of the war. At the same time I decided to begin a comprehensive osteological collection because on the one hand such a collection was frequently asked for by other colleagues and on the other hand, I needed one myself for a few investigations of reptile skulls. Even though the year 1939 and the year following were not good for such work, nevertheless by means of purchase and exchange, through several gifts, and finally by use of old specimens, an osteological collection was put together representing three groups: turtles, crocodiles and *Varanus*. Of the latter, the museum possessed at this time only 3 skulls, 14 of crocodile. In spite of the times it was possible to increase the number of skulls to 73 of *Varanus* and 155 of crocodiles. Today there are 98 *Varanus* and 269 crocodile skulls, both, as far as number is concerned, the most complete collections of their kind. A detailed catalog of the crocodile collection was prepared for publication at this time. It did not appear, however, until the end of 1943. Also a monograph on the family Varanidae was prepared in the two first years of the way, chiefly during the night hours in the museum since it was possible to work relatively undisturbed at night.

Little by little new specimens were added to the collection, but only to a very modest extent. They came from the many friends of *Senckenbergianum* who had been sent as soldiers to the various theaters of war. The field post proved to be of no small value to the collection and to science. Small packages came from Norway, France, Italy, Tunisia, Libya, Greece, Rumania and Russia. Even today I regard these friendly assistants of those dismal times with gratitude and am happy that their work was not in vain, since almost all of their gifts are still in good condition and have answered many questions in the field of European herpetology. On the other hand the quite unmilitary activity would have given the collector a little excitement. So many of

them might have smiled with the recipient of the gifts when a scientific colleague in the museum declared, in all seriousness, these shipments to be a "misuse of the field post".

The history of the destruction and bombing of the museum at the beginning of 1944 is known. The depressing feeling that one feels at the sight of hundreds of chests and casks of valuable specimens can only be understood by one who has a sense of order and who experiences a joy in the observation of a well ordered collection. Therefore the anxious question arose again and again: what would be the fate of this unique collection? The most valuable part of the collection, a third of it, was sent along with the books to Oberlais, a small upper Hessian village between Nidda and Hirzenhain. There, the collection was so arranged in a dance hall that it could still be used for research purposes. A further third was sent to Diedenbergen in the vicinity of Hofheim in Taunus where it occupied a roomy underground wine cellar. The remaining third was left in Frankfurt. However,fate was kind. Without mentionable loss -- it was a matter of a few beautiful exhibit pieces -- I could again rearrange the herpetological collection in the museum, for the third time in my life, toward the end of 1946. The space on the first floor and basemant available at the beginning of the war was expanded. The lecture room was divided into work room, collection room and library so that from the year 1950 on, systematic scientific work in the herpetological section was again possible. Again and again it proved to be important that not only the exhibit collection but also the research collection be arranged in an attractive manner. Clean jars filled with clear alcohol and having legible labels, arranged on simple but orderly shelves and in addition beautifully bleached skulls and skeletons enclosed in cabinets provide the best possible means of promoting the further growth of the collection. The herpetological collection, thus arranged, often displayed to touring visitors, gained it many valuable specimens donated by scientists and friends.

From now on, at last, a regular increase of the collection could be planned. Old exchange relations could be established again and new ones begun, and now more money was available than before for purchase of specimens. In this connection Dr. W. Klingelhoffer (1871-1953) should be mentioned. He was an enthusiastic terrarium lover and turtle fancier who, shortly before his death, willed his house in Neu-Isenburg to the herpetological section of the Senckenberg Museum. This profitable bequest was supposed to be used for the further development of the collection. The sale of the house made possible the purchase of many valuable specimens. Important collections from the Galapagos, the New Hebrides, the Fiji Islands, the Philippines and New Guinea, have come in later years into the museum with the help of financial subsidies.

As after World War I, the time had come to anticipate the realization of many plans for travelling. The prospect was regarded with joy in the early summer of 1947 to take a trip to Passau along with some herpetological friends in order to collect the emerald and wall lizards as well as the *Natrix natrix* and *Elaphe longissima*. Not until

I began my last extensive trip abroad early in January 1957. I stopped first for two weeks in Bogor, the beautiful Buitenzorg of the Dutch Colonial time, and worked in the well known Botanical Gardens there as well as in the reigon of the mountain station Tjibodas. Then I flew to Perth in Southwest Australia and from there set forth on a journey with Dr. H. Felten. After a stop during which I studied in the museum in Perth and made several impressive trips to the far southwest, we flew to Adelaide and toward the end of March arrived in Alice Springs in Central Australia. That was the base for longer trips to Ayers Rock and Palm Valley near the mission station of Hermannsburg. A stop of several weeks in Queensland and a visit to the museums in Brisbane, Sydney and Melbourne ended this rewarding trip which netted me a living *Spehendon*, on the way back, in Auckland, New Zealand, a gift of the Department of Internal Affairs. The Australian collection consisted of 226 species represented by 1943 specimens, two thirds of which were new to the Frankfurt collection. The outstanding specimens in this collection were four giant varanus (*Varanus giganteus*) and five long nosed crocodiles (*Crocodylus johnsoni*) which are considered the objects of greatest value in the museums of Europe. After the end of the Australian trip, there followed in the fall of the same year a trip along the Jugoslav and Greek coasts. The stop in Dubrovnik made possible the capture of *Lacerta oxycephala* and in Kalamata that of *Lacerta peloponnesiaca*.

Several smaller trips to collect island reptiles in the Mediterranean area followed. So in September 1958 I stopped to collect *Lacerta danfordi* in Rhodes. A voyage was made in the following year to Istanbul, the coasts of the Crimea and the coasts of the western Caucasus and I succeeded in May 1960 in making a much desired trip to Corfu to collect a series of desired species, among them the first record of *Agama stellio* for this island. I spent October of the same year at Positano on the Gulf of Salerno in order to visit a few islands of this gulf and to collect new lizards there. I also visited Capri again. I set forth on these island voyages finally in 1961 and spent beautiful, rewarding days, first on the island of Ponza, then on Malta, here mostly in order to get the melanistic Filfola Lizard (*Lacerta f. filfolensis*) and a larger series of the *Lacerta filfolensis maltensis*, that I had described in 1921. In 1962 and 1963 I travelled to the Ponza archipelago and to Egypt; and in 1964 and 1965 I made two flights far into Russia -- from Leningrad to Lake Baikal and from the Caucasus to the base of the Tienschan and paid my respects in several museums to colleagues. In July 1966 I attended the International Symposium on Venomous Animals at the Butantan Institute in Sao Paulo where I enjoyed the hospitality of Dr. A. R. Hoge and later in Rio de Janeiro that of Bertha Lutz.

In the field one has the most beautiful opportunity to get acquainted with living animals. The colors of many frogs, lizards and snakes are most delicate and lose their intensity and quality after death. How often have I been surprised on my trips in a colorful frog or a lively colored lizard which at first appeared unknown to me, and after looking at the outer characteristics to recognize a well known

early in 1949 could I make the first extensive trip abroad. Upon invitation of the current military authorities a long visit to the United States was granted to me and I not only worked for several weeks in the museums in Chicago and New York but also with the help of friendly American colleagues made many excursions in California and Florida. Through all this the Senckenberg collection was enriched by 146 different forms, mostly new to the collection, of about 600 specimens. In 1950 I accepted an invitation, extended to me through Prof. Adolf Meyer-Abich, to work for six months in the Instituto Tropical de Investigaciones Cientificas of the University in San Salvador and to investigate the herpetofauna of this Central American Republic which was little known at that time. I returned in 1950 with beautiful specimens and the El Salvador collection was increased in later years by the trips made possible through the Senckenberg Institute by Dr. A. Zilch, Dr. H. Felten, Dr. O. Schuster, Dr. E. Mohn. While I made only one collecting trip to the southern Alps in 1951, a year later I prepared for a greater undertaking which led me first to the Transvaäl Museum in Pretoria as a guest of Wilhelm Schack (who had died in the meantime) then to Southwest Africa where I became acquainted with the herpetofauna of Nambib on a few impressive excursions. The capture of *Palmatogecko*, *Ptenopus*, *Bitis caudalis* and *Naja nigricollis* are even today unforgettable adventures. Then there followed a few weeks in Cape Town and its incomparabily beautiful environs, in East Africa (Nairobi) as a guest of Peter Bally and finally in West Pakistan as a guest of M. Georg Konieczny, where several excursions were undertaken to the lower Hab river mouths and the Indus with their rich turtle fauna (*Kachuga*, *Lissemys*, *Chitra*). Since this time, thanks to the zeal of M. G. Konieczny, the relation of the herpetological section to the fauna of Pakistan has become so close that the Senckenberg Museum possesses a complete collection of beautifully prepared specimens from this country. In 1954 I received an invitation to work in the well known Instituto Butantan in Sao Paulo. In October I began the journey to Brazil, stopped for a short time in Rio de Janeiro and then spent 10 rewarding weeks in Sao Paulo. The highpoint of this visit was an excursion led by Dr. A. R. Hoge to the island of Queimada Grande, the locality of *Bothrops insularis*, and to the Island of Buzios, the herpetofauna of which had not been investigated at that time. Having been presented with valuable snakes and other reptiles I left the hospitable institute, at the time under the leadership of Afranio do Amaral, and landed early in January 1953 in Lima, the capital of Peru. There I was not only taken care of by Dr. Koepcke and his wife but also on several informative excursions was made acquainted with the land and its fauna. A trip into the high Andes, to the Junin Lake at an altitude of 4125 meters, resulted in a fine collection of the giant *Batrachophrynus macrostomus* and other kinds of frogs. I finished the South American trip in March with a stop in Venezuela where I stayed mainly in Caracas and in the Station "Rancho Grande". The latter is situated in a high cloud-forest (1100 meters) and is the locality of *Gastrotheca ovifera*. In 1956 I made two small trips: one to the Island of Majorca and a second to Rumania at the invitation of the Rumanian Institute for Cultural Relationships Abroad.

species long known to me as a preserved specimen. Even if the chief purpose of a research collection is to advance pure taxonomic studies, it has been called upon more and more in the last decades to answer questions on problems in the fields of animal geography, ecology, ethology and last but not least in evolution. In the next chapter a brief overview will be given of the extent to which this affects Senckenberg. Therefore it is evident that it is highly desirable to supplement a collection of alcohol preparations, skulls and skeletons and dried skins with living animals. These can be of essential assistance even in solving many taxonomic problems.

The observation of living creatures I always found in my youth to be a stimulating complement to the study of preserved material. The fine difference between races and even species of wall lizards would never have been so clear to me had I not studied living specimens of most forms. Even if the observation of animals in the midst of their natural habitat is especially worthwhile, the observation of living reptiles and amphibians in captivity should not be relinquished. Therefore an extensive collection of living animals, partly in the terraria of the museum and partly in my private collection, has for many years been an important part of the herpetological collection. In the course of years after the first world war, over 1500 species and subspecies of reptiles and amphibians were brought together in my greenhouse and at the present time this collection consists of around 250 forms. In it are found great rarities seldom found in alcohol-collections as for example of lizards *Rhacodactylus leachianus* and *ariculatus*, *Varanus prasinus*, *Lanthanotus borneensis*, of poisonous snakes *Walterinnesia aegyptia*, *Pseudocerastes persicus* and *Bothrops insularis*, of turtles *Pyxidea mouhoti*, *Testudo geometrica*, *Carettochelys insculpta*, *Emydura albertisi* and *Elseya dentata*. A pair of Tuatara *(Sphenodon punctatus)* have long been the crowning glory of the inventory of living animals. The exact dates for each single animal are kept in a special card catalog.

Usefulness and scientific value of a collection is unthinkable without a library. Therefore at the same time that I took over the section I put great emphasis on the acquisition of a well ordered herpetological library. Fortunately Boettger had left behind a collection of reprints that was extraordinary for that time. A further collection was made through my own activities, through purchases and exchange, whereby such works were sought that were considered most desirable for the Senckenberg Library. So the herpetological library consists at this time of three separate parts: first, books from the old museum book collection belonging to Boettger's time; second, books on permanent loan from the Senckenberg Library, mostly of valuable older works which are unique; and lastly, books from my private collection. The latter is the largest third. Unfortunately there are still a few gaps in the separate collection, especially for the years 1910-1920, and the period of the second World War. Great care is taken to see to it that the separates and books in the collection are used only in the building.

As far as personnel is concerned in this period, all of the work up to 1943 was done by me, including cataloging,labelling, letter writing, typing of manuscripts, proof reading, preparing specimens and so on. At that time the herpetological and ichthyological sections were combined. In addition, from 1919 to 1953 I had charge of the mammal section and from 1923 to 1947 the bird section as well. From 1934 to 1955 I was head curator of the zoological department and from 1947 to 1960 I was director of the museum. My only helper at first was my wife, who had to give up her work in the museum during the war. At the beginning of 1943 Mrs. Aenne Bringezu was assigned to me. She took over the herpetological library and made a detailed index for my *Varanus* monograph. After the war Mrs. Bringezu took over the journal exchange while for the technical work on the collection Miss Enka Schirner (who had been in the museum since 1943) came in as laboratory assistant and later Miss Margot Perl (who had been in the museum since 1939) was added. The growth of correspondence, the transcription of manuscripts and proof-reading took up so much time that Miss Schirner was appointed secretary in 1950. The importance of the collection had become noteworthy.

After Dr. Edith Bimmer had served for a long time as a volunteer, cataloging the snakes, the *Deutsche Forschungsgemeinschaft* hired Wolfgang Klausewitz in the herpetological section from 1952 to 1954. He received his doctor's degree in 1952 with his work on cytodiagnostic investigations on living blood and lymph cells of a few species of amphibians. He then published a series of herpetological works, for example on the chromatophores of a few lizards and on the behavior of *Agama cyanogaster* and further on taxonomic problems of the latter species and of *Chalcides chalcides*. When a place as a regular assistant was made for him, he took over on my suggestion the curatorship of the ichthyological collection that had been neglected and was not then an independent collection. During his participation in the last Hans-Hass Expedition he worked in the Maldive Islands as a herpetological collector and obtained thus for Senckenberg the first representation of its herpetofauna.

His successor as assistant in herpetology was Konrad Klemmer who, toward the end of 1957, received a degree with his work on the significance of craniological characters in taxonomy of wall lizards. Along with these problems he was occupied with the herpetofauna of the Iberian Peninsula and Morocco. He published a check list of poisonous snakes and made 6 herpetological field trips: in 1955 to Sicily and the Aegean Islands, in which he discovered a remarkable race of the Sicilian *Lacerta wagleriana*; in 1959 to the Iberian peninsula where he was fortunate in collecting the rare *Algyroides marchi* and in solving the *Lacerta hispanica* problem; then in 1961 to Morocco and again to the Iberian peninsula in 1963 and finally in 1966 he went to the Cilician Taurus in Asia Minor. He took part in the aforementioned Symposium at the Butantan Institute in July of the same year and after it closed he visited several museums in the United States.

At the end of 1963, Miss Perl transferred to another department.

AS an additional laboratory worker, in 1952, I had taken Miss Edelgard Krienitz into the section after three years of training. She left early in 1961. Her successor up to the beginning of 1966 was Miss Marion Belzer. Ingrid Borchers and Jutta Schafer took her place in 1966.

If the number of species in the herpetological collection in 1922 was 2,535, today I estimate it to be over 4,500, whereby to be sure the subspecies are considered. Likewise the number of specimens have increased from 21,381 to around 90,000 and of these only 64,124 have been identified and catalogued. For several years the herpetological section has had a stamping machine with which consecutive numbers can be stamped on small parchment labels. These labels are tied to each specimen so that if space, jars or alcohol are scarce, several individuals from different places can be put into one jar. It has appeared to be very practical, in a collection that has now become very extensive, to maintain as far as possible an alphabetic sequence of the lower taxa -- that is to set up genera within families, species within genera, subspecies within species, alphabetically. A research collection represents an archive, as we have said before, and as such must be arranged so that any desired specimen can be found in the shortest possible time.

IV. THE VALUE OF THE COLLECTION TO SCIENCE.

The herpetological collection of Senckenberg demonstrates its great scientific value by the fact that it has provided material for around one thousand publications that have come out of Senckenberg or other institutions. In its orderly arrangement, it is available at all times and stimulates research inasmuch as the many specimens that have not yet been studied are of inestimable value for further research. Among the specimens upon which publications have been based, the types (hologypes, lectotypes and neotypes) are by far the most valuable since they are of documentary importance in themselves. Such types have been the source of 542 published names of the lower taxa (species, subspecies and varieties). A list of them is found at the end of this historical sketch. They represent the work of the following 37 authors: E. Ahl, F. Angel, M. Basoglu, C. R. Boettger, O. Boettger, G. A. Boulenger, E. Buck, I. S. Darevsky, I. Eibl-Eibesfeldt, J. G. Fischer, L. J. Fitzinger, A. Fritze, J. E. Fuhn, J. E. Gray, M. Hartmann, C. von Heyden, G. Jan, W. Klausewitz, K. Klemmer, L. Lortet, L. von Mehely, R. Mertens, A. von Mojsisovics, L. Muller, G. Pasteur, H. Pieper, M. Radovanovic, A. Reuss, T. Reuss, J. Roux, E. Ruppell, K. P. Schmidt, F. Siebenrock, R. Sternfeld, H. Wermuth, O. von Wettstein and W. Wolterstorff. The collection is no less important because of its many paratypes and syntypes which to be sure have no documentary value such as the types mentioned above but in spite of that facilitate the work of identification.

It is natural that in a collection definite groups of animals, according to the inclinations of those responsible for it, become especially favored and for this reason are well represented. Crocodiles and turtles are especially favored in Frankfurt. The former with the exception of a few questionable species are fully represented. Of the latter, the collection includes 260 different species and subspecies -- 77.7 percent of the 332 known at this time. The collection of *Varanus* (Varanidae) that I have built up contains 51 of the 58 forms known (87.9 percent). The genus *Lacerta* demands special attention with its countless island forms of the Mediterranean area, and also the climbing, extremely adapted genus *Chamaeleon*. In the case of the importance of geographical races for questions of speciation, emphasis is placed on the value of faultless preparations not only of *Lacerta* but also of variable tropical lizards (for example *Ablepharus boutonii*). There is a good collection of *Vipera berus* and *Natrix natrix*. The latter includes 400 specimens in which all of the subspecies are represented.

Aside from being important to the field of taxonomy, the collection is of great value for the study of faunistics of certain areas. That the herpetofauna of the Rhein-Main area occupies a prominent place is understandable, and the collection has been augmented by too many people to count. The reptiles and amphibians of the world are so well represented that the collection could form the basis of an inventory of them. From the following European areas there are especially good collections (only the most important collectors' names are given in parentheses): Portugal and Spain (V. L. Seoane, F. Haas, K. Klemmer, A. Gilbert), Pityusan and Balearic Islands (A. Fahr, P. Kuliga, Z. Kamer, H. Grun, R. Mertens), France (L. A. Lantz, K. L Koch, W. Friese, F. Medem, W. Hohorst, J. Steinbacher, W. Banzhaf), Austria (A. Mariani), Switzerland (R. Mertens, M. Schatty, H. Schweizen), Italy (R. Mertens, P. Giesler), Elba (H. Kahmann, R. Rau, K. Walch), Corsica (H. Kahmann), Sardinia (H. Kahmann, H. Felten, J. Steinbacher). Pontine Islands (R. Mertens), Aeolian Islands (A. Trischitta), Sicily (K. Hirsch, R. Mertens, J. Steinbacher, A. Trischitta, K. Klemmer), Pantelleria, Linosa and Malta (R. Mertens, P. Giesler), Jugoslavia (G. Kramer, W. Kisselbach, S. Brelih, M. Radovanovic), Albania (K. Muller), Corfu (R. Mertens), Greece (C. Conemenos, A. Tolksdorf, H. Bob, E. Schirner, R. J. Clark), Milos (H. Schweizer, H. Kratzer), Bulgaria (J. Buresch), Rumania (L. Witzel, R. Mertens, J. Fuhn), Ukrain and the Crimea (O. Retowski, J. Jaeschke, H.-Th. Rust, Th. Haltenorth, A. Marherr, G. Steinbacher, F. Neubaur, F. Medem).

From Africa collections from the following areas are outstanding: Madeira (R. Mertens, G. Maul), Canary Islands (C. R. Boettger, J. Jaeschke), Morocco (C. von Fritsch & J. J. Rein, H. Simon, K. Klemmer), Algeria and Tunisia (A. Konig, W. Kobelt, R. Mertens, H. Kahmann, J. Steinbacher, K. Walch), Lybia (H. Kaltenbach, W. Sturmer, G. Boss), Egypt (E. Ruppell, A. Andres, M. G. Konieczny, K. E. Linsenmair, J. Kiepenheuer), Sierra Leone (L. G. A. Hoevers), Cameroon (A. Haas, expedition of the Duke Adolf Friedrich of Mecklenburg, R. Mertens, M. Kohler, H. Graf, J. L. Perret), Fernando Poo and other Guinea Islands

(expedition of the Duke Adolf Friedrich of Mecklenburg, H. Eidmann), Central Africa and the Congo Region (P. Hesse, expedition of the Duke Adolf Friedrich of Mecklenburg), Angola (F. Haas, W. Schack), Southwest AFrica (H. Schinz, F. Eberlanz, R. Mertens, W. Hoesch, H. Bachran, F. Gaerdes, E. Scherz, W. Triebner), South Africa (F. Haas, R. Rau), Rhodesia (F. Haas, D. G. Broadley, East Africa (H. Grote, F. Kinkelin, L. Kohl-Larsen, A. Voeltzkow, C. R. S. Pitman), Sudan (Chr. Scherpner), Ethiopia (E. Ruppell, D. Starck), Madagascar (A. Stumpff, C. Ebenau, A. Voeltzkow, H. Bluntschli, K. L. Koch, K. Martens), Comoro Islands (A. Voeltzkow), Aldabra (A. Voeltzkow), Seychelles (A. Brauer, R. Honegger).

From the Asiatic continent including the Indo-Australian Islands, the following collections are worthy of mention: Caucasus and the border areas to the south of them (H. Leder, G. von Radde and J. Valentin, I. Darevsky), Turkey (C. Kosswig, M. Basoglu, R. Richter, K. Klemmer, J. Schmidtler, Iran (M. G. Konieczny, G. Schubert, M. Latifi), Israel (H. Simon, H. Zinner), Sinai (E. Ruppell, A. Kneucker), Iraq (K. T. Khalaf), West Pakistan (M. G. Konieczny, R. Mertens), India (Th. Kolb), Maldive Islands (W. Klausewitz), China (B. Schmacker, M. Kreyenberg, O. Herz, O. von Moellendorff), Riu Kiu (B. Schmacker), Thailand (G. Dietrich), Nicobar Islands (I. Eibl-Eibesfeldt), Philippines (O. von Moellendorff, H. Bregulla, W. C. Brown), Sumatra (F. Beyschlag, German limnological expedition), Java (H. L. Doebel, A. Strubell, H. Fruhstorfer, R. Mertens, G. Heberer, German limnological expedition, A. M. R. Wegner), Karimunjawa, Bawean and Kangean Islands (A. Hoogerwerf), Borneo (W. Kukenthal, A. M. R. Wegner), Celebes (J. Elbert, W. Kukenthal), Lesser Sunda Islands (J. Elbert, R. Mertens), Moluccas (W. Kukenthal, A. Strubell, A. M. R. Wegner), Aru and Kei Islands (H. Merton and J. Roux).

From New Guinea there is only a small collection for which E. Wolf, E. Reiner and Th. Schultze-Westrum are responsible. On the contrary, the herpetofauna of Australia is well represented through the facilitation by L. Glauert (Perth) of the trip of R. Mertens and H. Felten, as well as through a collection of M. von Leonhardi into the interior and of K. Immelmann into the Northwest section. From the Australian Islands collections should be mentioned from: the Bismarck Archipelago and Solomons (E. Wolf), the New Hebrides, Fiji Islands and New Caledonia (H. Bregulla), other West Pacific Islands east to the Tuamotu Archipelago (E. Wolf), New Zealand (H. Suter, E. S. Gourlay).

Finally a few comments should be made on collections from the New World. From the United States there are for the most part only single specimens from various localities that have been gathered together mostly by R. Mertens. Aside from these, mention should be made of the following: Mexico (H. O. Wagner, W. Peters), Guatemala (K. Fleischmann), El Salvador (R. Mertens, E. Fischer, A. Zilch, O. Schuster, H. Felten, E. Mohn), Jamaica and Cayment Islands (A. Reichardt), Hispaniola (H. Boker, E. Roloff, R. Mertens), St. Thomas (K. Knoblauch, R. Mertens), Trinidad (F. W. Urich, R. R. Mole), Venezuela and the off-shore islands (G. Hubner, F. Mauss, R. Mertens, I. Eibl-Eibesfeldt), Columbia (F. C. Lehmann, F. Medem), Ecuador (F. C. Lehmann),

Galapagos (I. Eibl-Eibesfeldt), Peru (F. Emmel), H.-W. Koepcke, W. Weyrauch, R. Mertens), Brazil (H. v. Ihering, W. Ehrhardt, A. Adolff, K. Emrich, H. Rohde, P. Giesler, A. and B. Lutz, H. Sick, A. R. Hoge, W. C. A. Bokermann, R. Mertens, K. Klemmer), Argentian (C. Berg, J. Valentin, A. von Leers, H. Best), Chile (H. Riegel).

It is not within the scope of this work to mention all of the taxonomic faunistic works that have been based on other parts of the collection. Aside from the types, the collection includes many specimens that represent new locality records. Boettger's basic overview of the herpetofauna of various parts of the world has already been mentioned. In the last decade the material in Senckenberg representing the following areas has appeared in print: the Rhine-Main area, Northeast Spain, the Lesser Sunda Islands, Santo Domingo, El Salvador, Cameroon and Southwest Africa. The work on the herpetofauna of Europe that I did first with L. Muller, then published with H. Wermuth, has already been mentioned. Of the foreign monumental works for which the Senckenberg material has been extensively used, only three examples will be mentioned here: John Anderson's "Zoology of Egypt, Reptiles and Batrachia" (1898), Leonhard Stejneger's "Herpetology of Japan and Adjacent Territory" (1907), and Clifford H. Pope's "The Reptiles of China" (1934).

Works not dealing with a particular area but with taxa have appeared likewise in impressive numbers: they concern revisions of species or races (*Abelpharus boutonii*, *Eumeces schneiderii*, *Dasia smaragdina*, *Natrix natrix*), genera (*Phelsuma*, *Dendrelaphis*), families (Varanidae, Chamaeleonidae, Elaphidae, Hydrophiidae, Viperidae, Crotalidae) and orders (Testudines, Crocodylia, Rhynchocephalia). From foreign authors the important work of Noble's on amphibians, Chang's on salamander genera, K. P. Schmidt's on *Micrurus*, and Taylor's on gymnophionans should be mentioned. The Senckenberg collection proved to be of great assistance to these works. My own works on the genus *Pelobates* and on the systematics of Crocodylia and *Varanus* were supported by the skull collection as was Klemmer's work on the genus *Lacerta*. In connection with the latter, the Hungarian scientist L. von Mehely should be mentioned who completed his basic work on the taxonomic relations of *Archaeolacerta* with the help of the Senckenberg collection. Mehely said that the most important phyletic relations were not clear to him until he studied these specimens. Of the non-taxonomic works, in which comparative morphology and functional studies are foremost, the informative work of Hofer on the skull of *Tupinambis* and of *Varanus* should be mentioned. He worked on it for the most part at Senckenberg because an extensive collection of these animals is available there. Hofer denied the earlier assumed metakinetics of the *Varanus*skull and proved a thynchokinetic possibility of movement. The classical works of W. J. Schmidt on the integument of reptiles would not have been as complete if this prominent scientist had not used the Senckenberg material. The series of his publications on this subject began with the Madagascar anguid, *Voeltzkowia mira*, described by Boettger. Also the work by Schmidt on the parietal organ of aurians should be mentioned; at the beginning of his activity Schmidt worked for the most part on Senckenberg material. Examples of other kinds of

work by scientists who were materially aided by the collection or who were inspired by it could be given. The zoogeographical conclusions drawn by Boettger from his industrious taxonomic work was put together by Kinkelin (1912). Boettger had pointed out the former connection between Morocco and Spain as well as between Algeria and Italy on the basis of the modern herpetofauna. As for the eastern Mediterranean region, he worked out the herpetofauna of the trans-Caspian in great detail. He was inclined to speak of a trans-Caspian province in the zoogeographical sense and emphasized its difference from the trans-Caucasian. He came to the conclusion that the lizards cross over the desert more easily than snakes, since for the former the high mountains represent easily surmountable barriers. On the basis of his many works on Madagascar, Boettger had always stressed the peculiarity of this great island and considered it to be almost in the class of a special region. He alluded above all to the individuality of the snake fauna since the genera that were significant for Africa were lacking on Madagascar whereas those that do occur were related to those of the New World. In the case of the lizards the association with Africa is more prominent but also here the high number of endemic forms is worthy of note, partly again in relation to the American forms. A theory of recent connection by land with Africa, Asia or Australia, he considered to be improbable. In analysis of the herpetofauna of southwest Africa, at that time practically unknown, Boettger came to the correct conclusion that the Orange River represents a rather sharp faunal boundary and the same can be said for the Congo. On the contrary the correspondence between the herpetofauna of the island of Hainan with that of southern China shows that here in spite of the wide channel between them a land connection must have existed quite recently.

Although Sternfeld had devoted his time predominantly to the African reptile fauna his most important zoogeographical speculations concerned the eastern part of the Sunda Archipelago and the island world of the western Pacific. He made the attempt to define the western limit of the Papuan faunal region and regarded the island of Ceram as the remains of a land bridge on which Papuan as well as oriental species could have reached the Kei Islands but not to the Aru Islands. Between these two island groups, separated from each other by a trench over 3,500 meters deep, the line passes that separates Asia from Australia and the orient from the Australian-Papuan region. One may basically agree to this point of view, but on the other hand modern zoogeography can scarcely be reconciled to other theories of Sternfeld. He emphasized correctly the peculiarity of New Caledonia and demonstrated the old neotropical element in Polynesian fauna: the iguanid genus *Brachylophus*, the boid genus *Enygrus* (now *Candoia*), and the *Typhlops* species that are more closely related to the New World fauna than to the Australian fauna. However, in order to explain these conclusions there remained for Sternfeld only the assumption of a great sunken mass of land in the southeastern Pacific Ocean. In his opinion the Galapagos Islands earlier belonged to this land mass: "The thought that the larger reptiles of these island groups were imported is simply absurd".

I, myself, was earlier under the influence of the zoogeographers of the old school and even expressed their opinions in writing, but I have become more prudent in the last decade. In my writing on the zoogeography of Hispanolia, the Sunda Archipelago and Australia, I was unable to account satisfactorily for it without land connection and assumed for the latter continent one such connection with South America which possibly ran over the Antarctic and connected Australia with the southern tip of South America during the Mesozoic. I made some zoogeographical observations, mostly on the basis of a few collections from field trips, on the Sunda Islands as the evolutionary center of the sea snakes, on the "Wallace Line", on Central America as a distinctive faunal zone, on the herpetofauna fo North America, Southwest Africa, and a few areas of the Mediterranean and especially on Sicily and its neighboring islands, Spain, the Balearian Islands and North Africa. I also worked with the reptiles of the Canary Islands and their Pleistocene fauna and proposed a theory of their continental origin. I further demonstrated, by certian peculiarities in the amphibian fauna of Middle Europe, the existence of certain parallels in the case of a few frogs (*Bombina, Rana*) and their relations to the Diluvial period; the advance of the glaciers obviously split up early uniform ranges of many species into separate areas and by this hastened the formation of races.

After the glaciers receded the ranges came together again and made possible the mingling of the forms that had been separated, which now behaved simply as species, that is, they did not interbreed. I also discussed the warmth loving lizards and snakes of Germany as relics of the warmer periods of the post glacial time, as well as the significance of the forest, the open spaces and the cultivated areas in the spread of species.

The remark has already been made that Boettger was anything but a field herpetologist. In spite of that we are grateful to him for a clear statement, written during his confinement, of the ecological relationships of the reptiles of the Transcaspian. The conclusions were based exclusively on studies that he made of preserved specimens. He discussed the phenomenon of adaptation of lizards and snakes to life in the desert: for example the scales as protection against all injuries from weather, the snout scales and limbs adapted for digging, the protection of the nasal openings, eyes and ear openings against the penetration of sand and dust -- the uniqueness of color and pattern. Even if amny of Boettger's conclusions later proved to be invalid through observations on living animals, they prevailed for over 75 years, doubtless under the influence of the point of view of Darwin's theory of selection -- much of which was correct. I found many parallels with it in the study on the Southwest African Namib desert reptiles when I was occupied with the problem of dependence of level of difference of certain peculiarities upon the geological age of the deserts. In sharp contrast to this is the adaptability of tree living reptiles and amphibians especially in the tropical rain forest. I studied them by groups, especially the snakes and the South American iguanid genus *Polychrus*.

In many cases ethological studies were likewise stimulated by the collection. The unusually flat, weakly ossified shell of the east African land turtle *Malacochersus tornieri* induced me to observe this strange creature for several years in a terrarium. The study of the body form and the scales of a few desert vipers of South Africa and of Pakistan led to the proof of the unique forward motion under the name of side-winder, known to differ from other vipers. The roomy hatching-pouch of certain South American tree frogs (*Gastrotheca ovifera*) inspired solving the problem as to how the fertilized egg gets into the pouch where they continue to develop. The larynx which in the case of the female Tokay (*Gekko gecko*) is not as well developed as in the male, led to the assumption that only the latter were able to make the well known gecko call which may play such an essential role in the sex life of this southeast Asian night lizard. Odd formation of scales, conspicuous color marks and other peculiarities of many foreign lizards and snakes which were studied both in living and preserved specimens inspired the desire to represent these phenomena in a uniform point of view. Thus my work on the warning and threat reactions of reptiles originated.

Aldo a few works on evolution have been published recently that were stimulated by interest in the collection. Deliberation on the cause of the very frequent appearance of melanistic lizards on islands, especially on the little islands of the Mediterranean, led to a monograph on insular characteristics of reptiles, color, body size, body form and behavior. Connected with this was a discussion of the important problems of insular race and species formation and the significance of geographical races in species formation (Migration principle). The earlier points of view on mimicry in snakes underwent a revision and were further extended with impressive examples of New World coral snakes. It is worthy of note that the cases cited by Sternfeld 50 years earlier of so-called mimicry in the case of procryptically colored snakes of Africa actually was considered valid in a serious discussion. The significance of the astonishing number of varieties of larval forms of frogs for evolution of these amphibians was likewise investigated and as the possibility of the appearance of subspecies and even species hybrids in the case of reptiles which for a time had been almost unknown.

Finally the herpetological section has cooperated wince 1950 in all possible ways with the International Commission on Zoological Nomenclature. I worked as member of this commission and was later assisted by Dr. Otto Kraus, curator of invertebrates. Thus many questions of nomenclature were cleared up and the stability of scientific nomenclature was strengthened.

THE LIST OF TYPES

In the preceding chapters on the historical development of the collection the types and those who described them were mentioned. A new list of these types will be given -- a revision of my 1922 list.

As mentioned earlier the new type list contains 542 scientific names of hologypes, lectotypes and neotypes. The very numerous paratypes or syntypes are not considered here.

The list is so arranged that always the scientific name is cited in the combination and orthographic form given by its author. These names are grouped into families which appear in systematic order. Within the families the genera, subgenera, species, subspecies and varieties are arranged alphabetically.

After the original scientific name with its author, the date is given and the literature citation. In the next line the category of the type is given. Lectotypes have been chosen form series of syntypes (formerly cotypes). With the designation of neotypes, I have been very restrained in accordance with Article 75 of the International Rules for Zoological Nomenclature. In the list there are only 7 neotypes: *Salamandra maculosa bejarae* Wolterstorff 1934; *Salamandra maculosa taeniata* var. *bernardezi* Wolterstorff 1928; *Salamandra salamandra hispanica* Wolterstorff 1937; *Hyla lafrentzi* Mertens and Wolterstorff 1929 ; *Gymnodactylus heterocercus mardinensis* Mertens 1924; *Pachydactylus dubius* Boettger 1881; *Lacerta lilfordi toronis* Hartmann 1953. These selections are at the moment well supported in the literature.

For these specimens the present collection number is given under SMF. In order to avoid confusion, the numbers from the old catalogs or lists are added (as far as possible); their titles are noted in the bibliography: Ruppell 1845 (= Kat. Ruppell), Boettger 1892, 1893, 1898 (=Kat. Boettger) or Mertens 1922 (= Kat. Mertens). In respect to the latter the number is omitted where the collection number in this catalog corresponds to that in Boettger's.

In a few cases two scientific names have been given to a single specimen. In most cases it is a matter of the second name being merely a "nomen novum" or a "nomen substitutum" for the type belonging to the original name. Occasionally, however, when a new name has been given to a specimen without knowledge of the old name, the collection number corresponding to the valid name is always accompanied by a reference to the second name. The same specimen can even be a holotype under one name (*Gongylus stumpffii* Boettger 1882) and at the same time a lectotype under another name (*Scelotes astrolabes* var. *boettgeri* Angel 1942).

Since a type can be only one specimen the statement of the number of specimens is not given and only the sex is mentioned. This, however, is not always certain so merely the age may be given (ad.,s.ad., or juv.). If the sex symbol is lacking, the specimen is not fully grown. The statement of type-locality ("terra typica") corresponds in general to that of the original text. Since political boundaries, especially those in Africa are unsure in many cases and known only to specialists, a consistently current allocation of type-locality to country must be waived. The questionable localities are in quotation marks. The abbreviations following the name of the collector are:

l. = collected, d. = gift, v. = purchased, m. = exchanged. Finally in the last line the presently valid name is included if it differs from the original name. This happens for the most part on the basis of our own re-examination of specimens or new revisions of other authors. It is true that many characters are subjectively evaluated and are dependent upon the taxonomic judgment of the scientist. In a few cases the status of the type is open and further revision is necessary.[1]

As a rule the types of an author remain in his own collection or in the collection of a museum in which he has worked. Nevertheless the types from the collection of a university which serve as teaching material, or types from a museum that has no research collection or finally types from private collections should be entrusted to the lasting care of a museum with an international reputation. It is therefore always commendable if the scientist responsible for such collections, so handles the types. Senckenberg has received a few types from other collections transferred by their far-seeing leaders, namely from museums in Bremen, Braunschweig, Zurich, Bogor as well as from the Zoological Institute of the University of Heidelberg.

All of the types of newts and salamanders described by Wolterstorff were in the museum in Magdeburg where they were destroyed toward the end of the war along with the Wolterstorff collection. It will surely prove to be necessary in taxonomic revisions of the future to locate, for designation of neotypes, the paratypes of Wolterstorff's taxa that are preserved in other museums, as has already been done for the races of *Salamandra salamandra* by J. Eiselt. In the case of *Euproctus asper castelmouliensis* and *Triturus vulgaris graeca*, for which Wolterstorff designated no single specimen of each as holotype, I considered it to be suitable to choose a lectotype from the syntypes of each present in the Senckenberg collection. On the other hand when Nelly de Rooij (1915) mentioned that in the British Museum she had examined Boettger's "types" of *Lygosoma sorex* and *Lygosoma kuekenthali* (which had understandably remained at Senckenberg) without giving their locality and collection number, she was in error. She admitted this to me in 1922 after the appearance of my first list of types. She had not understood that the lectotypes existed, but saw only the "cotypes" that the Senckenberg Museum had sent to the British Museum in exchange several years before. Later she referred to such specimens quite correctly as"One of the type specimens . . . in the British Museum."

At the beginning of this century Leonard Stejneger,the leading herpetologist of the United States, sent a card to me on Feb. 5,1923, after he had seen the list of types that came out in 1922. On the card he had written,"What a herpetological treasure house the Senckenberg Museum is."

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1. Translator's note: here, space allows only a list of names. The reader who is interested in the above data may consult the original article.

GYMNOPHIONA.

Caeciliidae.

Bdellophis unicolor Boettger.
Gymnopis multiplicata oaxacae Mertens.
Siphonops paulensis Boettger.

CAUDATA.

Salamandridae.

Euproctus asper forma *castelmouliensis* Wolterstorff.
Mertensiella luschani helerseni Pieper.
Salamandra maculosa subsp. *bejarae* Wolterstorff.
Salamandra maculosa taeniata forma *bernardezi* Wolterstorff.
Salamandra salamandra (= maculosa) hispanica Wolterstorff.
Triton maltzani Boettger.
Triton vulgaris subsp. *graeca* Wolterstorff.

SALIENTIA.

Pipidae.

Hymenochirus boettgeri camerunensis Perret & Mertens.

Pelobatidae.

Pelobates syriacus Boettger.
Pelobates syriacus boettgeri Mertens.
Elosia nasus meridionalis Mertens.
Hylodes fleischmanni Boettger.
Hylodes lehmanni Boettger.
Hylodes maussi Boettger.
Hylodes urichi Boettger.
Hylodes w-nigrum Boettger.
Leptodactylus novateutoniae Ahl.
Leptodactylus plaumanni Ahl.

Bufonidae.

Bufo arabicus Heyden.
Bufo regularis A. Reuss.
Bufo regularis pusillus Mertens.
Bufo variabilis var. *balearica* Boettger.
Bufo verrucigerus Mertens.
Nectophryne exigua Boettger.

Hylidae.

Corythomantis venezolana Mertens.
Hyla arborea var. *meridionalis* Boettger.
Hyla argenteovirens Boettger.
Hyla chinensis var. *immaculata* Boettger.
Hyla chinensis var. *simplex* Boettger.
Hyla cochranae Mertens.
Hyla columbiana Boettger.
Hyla dolichopsis var. *tenuigranulata* Boettger.
Hyla emrichi Mertens.
Hyla giesleri Mertens.
Hyla lafrentzi Mertens & Wolterstorff.
Hyla prosoblepon Boettger.
Hyla rueppelli Boettger.
Hyla salvadorensis Mertens.
Hyla semoni Boettger.
Hyla siemersi Mertens.
Hylella fleischmanni Boettger.
Nototrema pygmaeum Boettger.
Phyllomedusa rohdei Mertens.
Phyllomedusa trinitatis Mertens.

Brachycephalidae.

Dendrophryniscus stelzeneri dorsalis Mertens.
Dendrophryniscus stelzeneri fulvoguttatus Mertens.
Phryniscus laevis var. *exigua* Boettger.
Prostherapis herminae Boettger.

Ranidae.

Arthroleptis sechellensis Boettger.
Arthroleptis sternfeldi Ahl.
Arthroleptis taeniatus Sternfeld.
Chaperina friedericii Sternfeld.
Cornufer boulengeri Boettger.

Dendrobates ebenaui Boettger.
Hylella solomonis Sternfeld.
Ixalus granulatus Boettger.
Oxydozyga floresiana Mertens.
Rana baramica Boettger.
Rana elberti Roux.
Rana lemniscata Boettger.
Rana leytensis Boettger.
Rana microdisca Boettger.
Rana microdisca dammermani Mertens.
Rana moellendorffi Boettger.
Rana moluccana Boettger.
Rana okinavana Boettger.
Rana sanguinea Boettger.
Rana schmackeri Boettger.
Rana schubotzi Sternfeld.
Rana tigrina var. *verruculosa* Roux.
Sphenophryne wolfi Sternfeld.

Rhacoporidae.

Chiromantis kelleri Boettger.
Hemimantis horrida Boettger.
Hyperolius bolifambae Mertens.
Hyperolius koehleri Mertens.
Hyperolius krebsi Mertens.
Hyperolius kuligae Mertens.
Ixalus flavosignatus Boettger.
Ixalus schmackeri Boettger.
Leptopelis bocagei haasi Mertens.
Limnodytes granulatus Boettger.
Limnodytes ulcerosus Boettger.
Mantidactylus frenatus Boettger.
Mantidactylus multiplicatus Boettger.
Megalixalus fornasinii var. *unicolor* Boettger.
Megalixalus maculosus Sternfeld.
Megalixalus mocquardi Boettger.
Megalixalus schneideri Boettger.
Megalixalus tricolor Boettger.
Polypedates dispar Boettger.
Rana eiffingeri Boettger.
Rhacophorus bicalcaratus Boettger.
Rhacophorus difficilis Boettger.
Rhacophorus exiguus Boettger.
Rhacophorus isabellinus Boettger.
Rhacophorus javanus Boettger.
Rhacophorus obscurus Boettger.
Rhacophorus sikorae Boettger.

Microhylidae.

Calophrynus acutirostris Boettger.
Cophixalus geislerorum Boettger.

Cophyla phyllodactyla Boettger.
Dyscophus sanguineus Boettger.
Engystoma muelleri Boettger.
Gnathophryne boettgeri Mehely.
Mantella pollicaris Boettger.
Oreophryne rookmaakeri Mertens.
Oreophryne senckenbergiana Boettger.
Phrynixalus montanus Boettger.
Phrynocara laeve Boettger.
Phrynocara quinquelineatum Boettger.
Platyhyla voeltzkowi Boettger.
Rhombophryne testudo Boettger.
Stumpffia psologlossa Boettger.
Xenorhina dubia Boettger.

TESTUDINES.

Emydidae.

Clemmys caspica cretica Mertens.
Clemmys schmackeri Boettger.
Geoemyda punctularia diademata Mertens.

Testudinidae.

Kinyxis schoensis Ruppell.
Testudo boettgeri Siebenrock.
Testudo graeca var. *boettgeri* Mojsisovics.
Testudo hermanni robertmertensi Wermuth.
Testudo kleinmanni Lortet.
Testudo oscarboettgeri Lindholm.

Cheloniidae.

Caretta bissa Ruppell.

Pelomedusidae.

Pelomedusa subrufa wettsteini Mertens.
Pentonyx gehafie Ruppell.
Podocnemis madagascariensis var. *bifilaris* Boettger.

Chelidae.

Phrynops hogei Mertens.

CROCODYLIA.

Crocodylidae.

Crocodilus multiscutatus Ruppell.
Crocodilus octophractus Ruppell.

SAURIA.

Gekkonidae.

Cnemaspis koehleri Mertens.
Ebenavia inunguis Boettger.
Geckolepis polylepis Boettger.
Gehyra marginata Boettger.
Gekko gecko azhari Mertens.
Gymnodactylus fumosus halmahericus Mertens.
Gymnodactylus heterocercus mardinensis Mertens.
Gymnodactylus kotschyi lycaonicus Mertens.
Gymnodactylus laevis Sternfeld.
Gymnodactylus oertzeni Boettger.
Gymnodactylus trachyblepharus Boettger.
Hemidactylus flaviviridis Ruppell.
Hemidactylus frenatus var. *calabaricus* Boettger.
Hemidactylus granosus Heyden.
Hemidactylus robustus Heyden.
Holcdactylus africanus Boettger.
Hoplopodion rueppellii Fitzinger.
Lepidodactylus brevipes Boettger.
Lepidodactylus lombocensis Mertens.
Lygodactylus flavipicturatus flavipicturatus Pasteur.
Lygodactylus heterurus Boettger.
Lygodactylus insularis Boettger.
Lygodactylus robustus Boettger.
Lygodactylus tuberifer Boettger.
Lygodactylus tuberosus Mertens.
Microscalabotes spinulifer Boettger.
Nephrurus laevissimus Mertens.
Pachydactylus dubius Boettger.
Pachydactylus laticauda Boettger.
Pachydactylus punctatus scherzi Mertens.
Phelsuma abbotti menaiensis Mertens.
Phelsuma breviceps Boettger.
Phelsuma cepediana borbonica Mertens.
Phelsuma flavigularis Mertens.
Phelsuma guimbeaui Mertens.
Phelsuma laticauda angularis Mertens.
Phelsuma lineata bombetokensis Mertens.
Phelsuma lineata chloroscelis Mertens.
Phelsuma lineata dorsivittata Mertens.
Phelsuma lineata pusilla Mertens.

Phelsuma madagascariensis kochi Mertens.
Phelsuma madagascariensis martensi Mertens.
Phelsuma madagascariensis venusta Mertens.
Phelsuma serraticauda Mertens.
Phelsuma vinsoni Mertens.
Phelsuma vinsoni inexpectata Mertens.
Phelsumia laticauda var, *comorensis* Boettger.
Phelsumia lineata var. *bifasciata* Boettger.
Phelsumia micropholis Boettger.
Phelsumia v-nigra Boettger.
Phyllodactylus eduardofischeri Mertens.
Phyllodactylus (Phyllodactylus) oviceps Boettger.
Phyllodactylus (Phyllodactylus) stumpffi Boettger.
Pristurus flavipunctatus Ruppell.
Ptyodactylus guttatus Heyden.
Rhoptropus boultoni benguellensis Mertens.
Scalabotes madagascariensis Boettger.
Sphaerodactylus molei Boettger.
Stenodactylus scaber Heyden.
Uroplates ebenaui Boettger.
Uroplates sikorae Boettger.

Agamidae.

Agama arenaria Heyden.
Agama atricollis loveridgei Klausewitz.
Agama colonorum subsp. *fritschi* Buck.
Agama colonorum var. *impalearis* Boettger.
Agama cyanogaster yemensis Klausewitz.
Agama gularis A. Reuss.
Agama inermis A. Reuss.
Agama leucostygma A. Reuss.
Agama loricata A. Reuss.
Agama nigrofasciata A. Reuss.
Agama pallida A. Reuss.
Agama planiceps schacki Mertens.
Agama sinaita Heyden.
Amphibolurus barbatus minor Sternfeld.
Amphibolurus maculatus gularis Sternfeld.
Amphibolurus reticulatus major Sternfeld.
Dendragama fruhstorferi Boettger.
Diptychodera lobata Boettger
Draco haasei Boettger
Draco quadrasi Boettger.
Gonyocephalus beyschlagi Boettger.
Gonyocephalus modestus carinatus Sternfeld.
Japalura fasciata Mertens.
Leiolepis belliana rubritaeniata Mertens.
Phrynocephalus raddei Boettger.
Physignathus longirostris quattuorfasciatus Sternfeld.
Stellio cyanogaster Ruppell.
Trapelus flavimaculatus Ruppell.

Tympanocryptis lineata centralis Sternfeld.
Uromastyx dispar Heyden.
Uromastyx acanthinurus flavifasciatus Mertens.
Uromastyx ornatus Heyden.

Chamaeleonidae.

Brookesia minima Boettger.
Brookesia stumpffi Boettger.
Chamaeleo affinis Ruppell.
Chamaeleo (Chamaeleo) simoni Boettger.
Chamaeleo dilepis martensi Mertens.
Chamaeleo ebenaui Boettger.
Chamaeleo montium grafi Mertens.
Chamaeleo radamanus Mertens.
Chamaeleo vulgaris var *recticrista* Boettger.
Chamaeleon monoceras Boettger.
Chamaeleon ruspolii Boettger.
Chamaeleon semicristatus Boettger.
Chamaeleon voeltzkowi Boettger.

Iguanidae.

Amblyrhynchus cristatus albemarlensis Eibl-Eibesfeldt.
Amblyrhynchus cristatus hassi Eibl-Eibesfeldt.
Amblyrhynchus cristatus venustissimus Eibl-Eibesfeldt.
Anolis brevipes Boettger.
Anolis chlorocyanus aliniger Mertens.
Anolis chlorocyanus cyanostictus Mertens.
Anolis chlorocyanus peynadoi Mertens.
Anolis cybotes saxatilis Mertens.
Anolis distichus albidogularis Mertens.
Anolis distichus ignigularis Mertens.
Anolis heteropholidotus Mertens.
Leiocephalus personatus arenicolor Mertens.
Leiocephalus personatus pulcherrimus Mertens.
Leiocephalus personatus trujilloensis Mertens.
Liolaemus lenzi Boettger.
Liolaemus lutzae Mertens.
Sceloporus jarrovii erythrocyaneus Mertens.
Tropidurus occipitalis koepckeorum Mertens.
Tropidurus peruvianus salinicola Mertens.
Uracentron werneri Mertens.

Anguidae.

Euprepis fasciata A. Reuss
Ophisaurus wegneri Mertens.
Pseudopus apus forma *ornata* Boetter.

Varanidae.

Varanus acanthurus brachyurus Sternfeld.
Varanus indicus rouxi Mertens.
Varanus microstictus Boettger.
Varanus ocellatus Heyden.
Varanus (Odatria) storri Mertens.
Varanus (Odatria) tristis centralis Mertens.
Varanus (Psammosaurus) griseus konieczyni Mertens.
Varanus russelii Gray.
Varanus timorensis scalaris Mertens.
Varanus (Varanus) gouldii flavirufus Mertens.

Cordylidae.

Gerrhosaurus auritus Boettger.
Gerrhosaurus flavigularis var. *quadrilineata* Boettger.
Gerrhosaurus rufipes Boettger.
Gerrhosaurus rufipes var. *subunicolor* Boettger.

Scincidae.

Ablepharus boutoni africanus Sternfeld.
Ablepharus boutoni aldabrae Sternfeld.
Ablepharus boutoni var. *atra* Boettger.
Ablepharus boutoni australis Sternfeld.
Ablepharus boutoni var. *bitaeniata* Boettger.
Ablepharus boutoni caudatus Sternfeld.
Ablepharus boutoni var. *cognatus* Boettger.
Ablepharus boutoni pulcher Sternfeld.
Ablepharus boutoni punctatus Sternfeld.
Ablepharus boutoni voeltzkowi Sternfeld.
Ablepharus boutonii litoralis Mertens.
Chalcides chalcides mertensi Klausewitz.
Chalcides ocellatus linosanus Mertens.
Cryptoblepharus boutonii aruensis Mertens.
Cryptoblepharus boutonii degrijsi Mertens.
Cryptoblepharus boutonii novocaledonicus Mertens.
Cryptoblepharus boutonii renschi Mertens.
Cryptoblepharus boutonii schlegalianus Mertens.
Cryptoblepharus boutonii sumbawanus Mertens.
Dasia smaragdinum melas Mertens.

Dasia smaragdinum philippinicum Mertens.
Egernia striata Sternfeld.
Eumeces pavimentatus var. *syriaca* Boettger.
Euprepis septemtaeniatus A. Reuss.
Feylinia macrolepis Boettger.
Gongylus stumpffi Boettger.
Leiolopisma sembalunicum Mertens.
Lygosoma albofasciolatum boettgeri Sternfeld.
Lygosoma cyanogaster aruensis Sternfeld.
Lygosoma cyanogaster keiensis Sternfeld.
Lygosoma (Emoa) boettgeri Sternfeld.
Lygosoma (Emoa) kuekenthali Boettger.
Lygosoma (Emoa) sorex Boettger.
Lygosoma (Hinulia) annamiticum Boettger.
Lygosoma (Hinulia) fasciolatum intermedium Sternfeld.
Lygosoma (Hinulia) leonhardii Sternfeld.
Lygosoma (Hinulia) maindroni wolfi Sternfeld.
Lygosoma (Hinulia) quattuordecemlineatum Sternfeld.
Lygosoma (Homolepida) brevipes Boettger.
Lygosoma (Homolepida) moellendorffi Boettger.
Lygosoma jobiense elegans Sternfeld.
Lygosoma (Liolepisma) microcercum Boettger.
Lygosoma (Liolepisma) travancoricum var. *palnica* Boettger.
Lygosoma (Mocoa) orichalceum Boettger.
Lygosoma (Otosaurus) wolfi Sternfeld.
Lygosoma (Rhodona) planiventrale desertorum Sternfeld.
Lygosoma (Riopa) mentovarium Boettger.
Lygosoma (Riopa) pembanum Boettger.
Lygosoma smaragdinum elberti Sternfeld.
Lygosoma smaragdinum nigrum Sternfeld.
Mabuia albotaeniata Boettger.
Mabuia comorensis var. *infralineata* Boettger.
Mabuia quinquetaeniata scharica Sternfeld.
Mabuya hoeschi Mertens.
Mabuya logiloba triebneri Mertens.
Mabuya multifasciata balinensis Mertens.
Mabuya multifasciata tjendikianensis Mertens.
Otosaurus sternfeldi Mertens.
Riopa albofasciolatum poehli Mertens.
Riopa ruppellii Gray.
Scelotes astrolabi var. *boettgeri* Angel.
Scelotes braueri Boettger.
Scelotes intermedius Boettger.
Seps (Seps) chalcides f. *bilineata* Boettger.
Seps (Seps) mionecton Boettger.
Sepsina hessei Boettger.
Sphenomorphus sanctus tenggeranus Mertens.
Sphenomorphus vanheuri balicus Mertens.
Tiliqua occipitalis multifasciata Sternfeld.
Tropidophorus sinicus Boettger.
Voeltzkowia mira Boettger.

Lacertidae.

Ancanthodactylus boskianus var. *syriacus* Boettger.
Algira microdactyla Boettger.
Eremias heterolepis Boettger.
Eremias lineo-ocellata inocellata Mertens.
Eremias undata gaerdesi Mertens.
Eremias undata rubens Mertens.
Lacerta bedriagae paessleri Mertens.
Lacerta caucasica Mehely.
Lacerta danfordi pelasgiana Mertens.
Lacerta dugesii mauli Mertens.
Lacerta erhardii schweizeri Mertens.
Lacerta galloti gomerae C. R. Boettger & L. Muller.
Lacerta goliath Mertens.
Lacerta lilfordi toronis Hartmann.
Lacerta longicaudata A. Reuss.
Lacerta melisellensis aeoli Radovanovic.
Lacerta melisellensis jidulae Radovanovic.
Lacerta melisellensis mikavicae Radovanovic.
Lacerta melisellensis kornatica Radovanovic.
Kacerta nekusekkebsus thetidis Radovanovic.
Lacerta mixta Mehely.
Lacerta monticola cantabrica Mertens.
Lacerta muralis borromeica Mertens.
Lacerta muralis var. *raddei* Boettger
Lacerta muralis sebastiani Klemmer.
Lacerta muralis var. *valentini* Boettger.
Lacerta pityusensis kameriana Mertens.
Lacerta saxicola subsp. *armeniaca* Mehely.
Lacerta serpa subsp. *major* Mertens.
Lacerta sicula alvearioi Mertens.
Lacerta sicula astorgae Mertens.
Lacerta sicula bagnolensis Mertens.
Lacerta sicula flavigula Mertens.
Lacerta sicula insularum Mertens.
Lacerta sicula lanzai Mertens.
Lacerta sicula liscabiancae Mertens.
Lacerta sicula massinei Mertens.
Lacerta sicula medemi Mertens.
Lacerta sicula mertensi Wettstein.
Lacerta sicula palmarolae Mertens.
Lacerta sicula pirosoensis Mertens.
Lacerta sicula premudana Radovanovic.
Lacerta sicula premudensis Radovanovic.
Lacerta sicula raffonei Mertens.
Lacerta sicula trischittae Mertens.
Lacerta sicula tyrrhenica Mertens.
Lacerta sicula vesseljuchi Radovanovic.
Lacerta strigata wolterstorffi Mertens.
Lacerta trilineata dobrogica Fuhn & Mertens.
Lacerta wagleriana antoninoi Mertens.

Lacerta wagleriana marettimensis Klemmer.
Podarcis filfolensis maltensis Mertens.

Aniliidae.

Cylindrophis boulengeri Roux.

Colubridae.

Ablabes herminae Boettger.
Ablabes modestus var. *semimaculata* Boettger.
Ablabes philippinus Boettger.
Ahaetulla boiga intermedia Mertens.
Atractus lehmanni Boettger.
Brachyorrhos alternans A. Reuss.
Calamaria semiannulata Boettger.
Calamorhabdium kuekenthali Boettger.
Coluber albiventris A. Reuss.
Coluber bicolor A. Reuss.
Coluber digitalis A. Reuss.
Coluber eques A. Reuss.
Coluber insulanus Mertens.
Coluber lacrymans A. Reuss.
Coluber lippus A Reuss.
Coluber moilensis A. Reuss.
Coluber nummifer A. Reuss.
Coluber obtusus A. Reuss.
Coluber schmackeri Boettger.
Coronella laevis var. *hispanica* Boettger.
Coronella plumbiceps Boettger.
Cyclophis modestus var. *punctatolineata* Boettger.
Cynophis moellendorffii Boettger.
Dasypeltis scabra loveridgei Mertens.
Dendrophis calligastra keiensis Mertens.
Dinodon rufozonatum var. *formosana* Boettger.
Dispas (Heterurus) gaimardi var. *granuliceps* Boettger.
Dromicus biserialis eible Mertens.
Dromicus stumpffi Boettger.
Elapomorphus bollei Mertens.
Enhydris pakistanica Mertens.
Eteirodipsas colubrina var. *citrina* Boettger.
Fleischmannia obscura Boettger.
Geophis emmeli Boettger.
Geophis fulvoguttatus Mertens.
Gonionotus vossi Boettger.
Helicops bangweolicus Mertens.
Hemirhagerrhis kelleri Boettger.
Herpetodryas bernieri var. *trilineata* Boettger.
Heteroliodon torquatus Boettger.
Idiophis vaillanti var. *extensa* Boettger.

Leptognathus peruana Boettger.
Lioheterodon voeltzkowi Boettger.
Lycodryas sanctijohannis var. *mayottensis* Boettger.
Lycophidium capense mut. *multimaculata* Boettger.
Micrelaps muelleri Boettger.
Oligodon purpurascens kangeanicus Mertens.
Oxyrrhopus haasi Boettger.
Pareas moellendorffi Boettger.
Pararhadinaea melanogaster Boettger.
Pityophis intermedius Boettger.
Pliocercus elapoides salvadorensis Mertens.
Psammophylax rhombeatus var. *trilineata* Boettger.
Pseudoeryx plicatilis ecuadorensis Mertens.
Rhadinaea kinkelini Boettger.
Rhadinaea montecristi Mertens.
Rhadinaea pinicola Mertens.
Rhadinaea zilchi Mertens.
Rhinechis amaliae Boettger.
Sibynophis geminatus insularis Mertens.
Simotes hainanensis Boettger.
Simotes herzi Boettger.
Spilotes pullatus ater Sternfeld.
Stenophis longicaudus Boettger.
Tantilla brevicauda Mertens.
Tarbophis vivax f. *syriaca* Boettger.
Telescopus semiannulatus polystictus Mertens.
Tetralepis fruhstorferi Boettger.
Thrasops jacksonii mossambicus Mertens.
Tropidonotus (Macropophis) halmahericus Boettger.
Tropidonotus (Tropidonotus) punctiventris Boettger.
Zamensis bitaeniatus Boettger.
Zamenis diadema var. *atriceps* Fischer.
Zamenis ladacensis var. *subnigra* Boettger.
Zamenis viridiflavus var. *asiana* Boettger.

Elapidae.

Alecto bitorquata Jan.
Aspidelaps lubricus infuscatus Mertens.
Aspidelaps scutatus bachrani Mertens.
Callophis boettgeri Fritze.
Diemenia maculiceps Boettger.
Elapsoidea boulengeri Boettger.
Elapsoidea hessei Boettger.
Micrurus dissoleucus nigrirostris Schmidt.
Micrurus mertensi Schmidt.
Micrurus nigrocinctus wagneri Mertens.
Micrurus surinamensis pattereri Schmidt.
Naja anomala Sternfeld.
Rhynchelaps anomalus Sternfeld.
Atheris laeviceps Boettger.

Atheris laeviceps Boettger.
Atractaspis schultzei Sternfeld.
Bitis caudalis paucisquamatus Mertens.
Echis pavo A. Reuss.
Echis varia A. Reuss.
Rhinaspis illyrica velebitensis T. Reuss.
Vipera berus var. *ornata* Basoglu.
Vipera latifii Mertens, Darevsky & Klemmer.
Vipera russelii limitis Mertens.
Vipera schneideri Boettger.

Crotalidae.

Atropos nummifer Ruppell.
Lachesis medusa Sternfeld.
Trimeresurus luteus Boettger.

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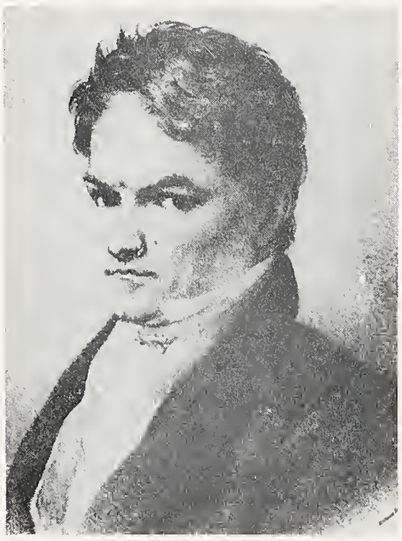
1. Das alte Museum Senckenbergianum

2. C. H. G. VON HEYDEN



3. E. RÜPPELL

Fig. 1 The Old Museum Senckenbergianum which opened November 22, 1821.

Fig. 2 Carl H. G. von Heyden (1793-1866), member of the Senckenbergischen Naturforschenden Gesellschaft. Although primarily an entomologist, he was the herpetologist from whom the first new descriptions came (1827-1830).

Fig. 3 Dr. Edward Ruppell (1794-1844), member of the Senckenbergischen Naturforschenden Gesellschaft and Frankfurt's most outstanding field zoologist. He was the author of the first printed catalog of the herpetological collection (1845).

4. O. Boettger.

5. R. Sternfeld.

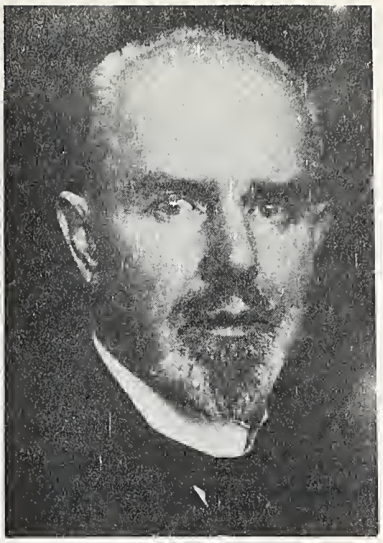
6. Das neue Senckenberg-Museum.

Fig. 4 Prof. Dr. Oskar Boettger (1844-1910) who established the international nature of the herpetological collection. He was its curator from 1875 to 1910 and in this time furthered herpetology as a science.

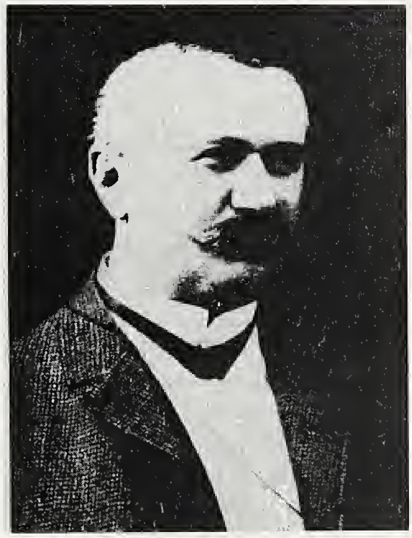
Fig. 5 Dr. Richard Sternfeld (1844-1943), one of Boettger's followers who was active between 1913 and 1920 as the herpetologist of Senckenberg.

Fig. 6 The Natural History Museum and Research Institute Senckenberg on the Senckenberg-Anlage, opened October 13, 1907. The upper story, destroyed in 1944, was rebuilt after the war in a simplified form.

7. O. F. von Moellendorff.



8. A. Voeltzkow.



9. W. Kukenthal.

10. E. Wolf.

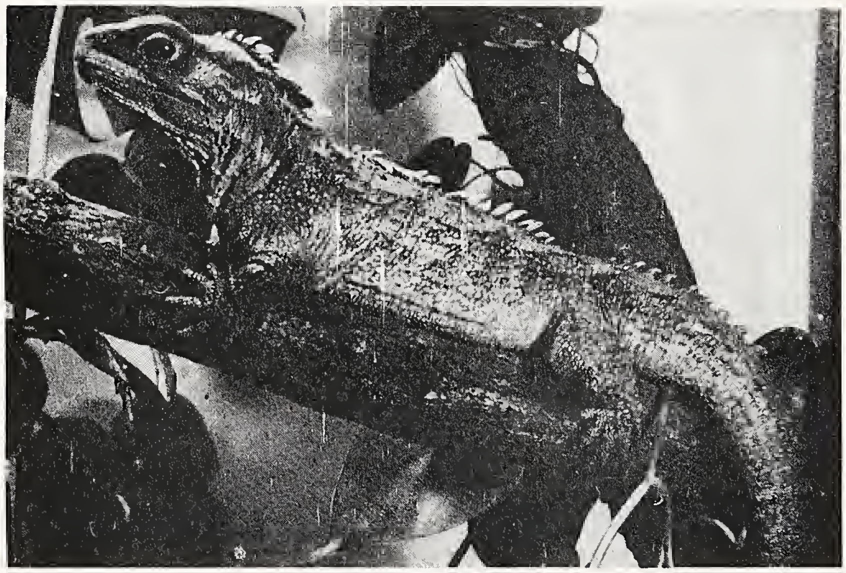
Fig. 7 Dr. Otto Franz von Muellendorf (1848-1903) German Consul in China and the Philippines. He collected molluscs but did not overlook reptiles and amphibians. These were studied and reported by O. Boettger.

Fig. 8 Prof. Dr. Alfred Voeltzkow (1860-1947), an independent scholar who made several long trips to Madagascar and the neighboring islands as well as to the east coasts of Africa. The very rich herpetological collections that he made contained many new forms, also studied and reported by O. Boettger.

Fig. 9 Prof. Dr. Willy Kukenthal (1861-1922), eventually director of the Zoological Museum in Berlin, collected in Borneo, Celebes, and the Moluccas near the end of 1893. His fine herpetological collection was studied and reported by O. Boettger.

Fig.10 Dr. Eugen Wolf (1876-1961) was an assistant from 1905 to 1911 and later active as curator. He accompanied the Hanseatic South Sea expedition as zoologist in 1909 and made a herpetological collection reported by R. Sternfeld.

11. Aus den herpetologischen Forschungssammlungen



12. Männliche Tuatara.

Fig. 11 A part of the crocodile skull collection made by the author.

Fig. 12 A male Tuatara (Bruckenechse), *Sphenodon punctatus*, in the terrarium of the herpetological collection.

Natural History Society of Maryland

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BULLETIN OF THE

Maryland Herpetological Society

The Natural History Society of Maryland, Inc.

JUNE 1969 VOLUME 5, NUMBER 2

Bulletin of the Maryland Herpetological Society

Volume 5 Number 2 June 1969

Contents

The Cover: An adult *Pseudotriton m. montanus*. Photograph by Dr. Charles J. Stine.

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BULLETIN OF THE

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Volume 5 Number 2 June 1969

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Moisture Toleration: A Possible Key to Dispersal Ability in Three Fossorial Lizards

David S. Lee

The present distribution of Florida's endemic lizards is puzzling. Carr (1940) believed that the species with narrow limits of ecological tolerance and/or poor dispersal ability remained within the outlines of Florida's Pliocene islands. Carr (1940) and Goin (1950) both recognized that most of central Florida's endemic herpetofauna consist of burrowing forms which are restricted to a few communities found on deep, loose Norfolk, St. Lucie, or Lakewood sands. It is obvious that a composite range of these burrowing endemics would represent a fraction of the available habitat in peninsula Florida (Carr 1940). The factors which govern this unique dispersal are poorly understood. In the following manuscript I hope to demonstrate the importance of soil water as a possible limiting factor in dispersal.

The lizards discussed, *Eumeces egregius lividus*, *Neoseps reynoldsi* and *Rhineura floridana*, are believed to have evolved on central Florida's Pliocene islands, yet their ranges are dissimilar. The burrowing habits and their varying degrees of specialization to subterranean existence make them interesting subjects for this study.

Methods

Captive lizards were observed in order to comment on moisture tolerance. Moisture tolerance is here defined as the per cent of water saturation at which the lizards can no longer efficiently burrow. Five hundred ml of Lakewood sand were oven dried to remove all moisture (0%). A specimen of the lizard species under observation was placed on the sand after it had cooled to room temperature. Once the subject had burrowed beneath the surface, water was slowly added to the sand. When the lizard was forced to emerge and remained uninterested (or unable) in reburrowing, the amount of soil water was recorded. (Equal volumes of sand and water here represent 100% moisture saturation.) The soil was kept loose so that it did not become packed to the extent that it would inhibit the lizards' activities. Ten trials on each species, using different subjects when possible, were performed and the average moisture tolerance calculated.

Results

The three lizards each demonstrated species specific moisture toleration (Fig. 1). *Eumeces ergegius lividus* could not tolerate soil water at the 14-39 (average 27.5%) saturation level. *Neoseps reynoldsi* had a smaller range of tolerance (20-27%) and could withstand less moisture on the average (23.0%) than *Eumeces*. *Rhineura floridana* was found to be much more tolerant of soil water than both the preceding species, not emerging until an average of 42.4 (35-50%) of water was present in the soil. At the same time it is interesting to note that of these three genera *Rhinerua* was the only one unable to burrow in soil completely void of water. Burrowing activities of this lizard were begun only when soil water reached the 6-9 (8.5%) level.

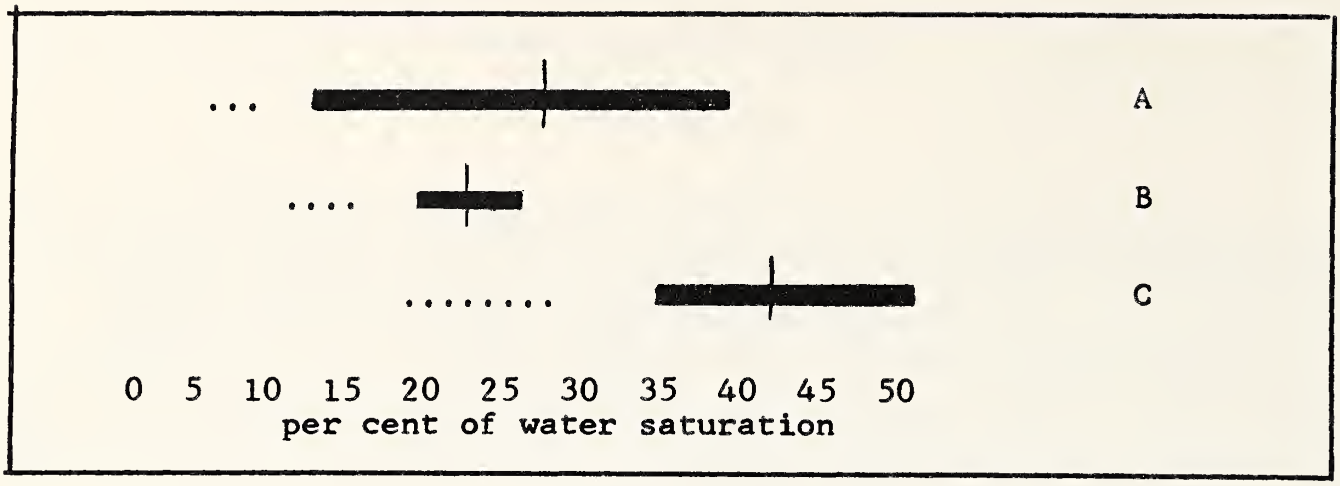

Fig. 1 Soil moisture conditions tolerated by three species of fossorial lizards. A-*Eumeces egregius lividus*; B-*Neoseps reynoldsi*; C-*Rhineura floridana*. Horizontal bars represent range of moisture toleration for each species. Vertical line denotes mean. Dotted line represents assumed moisture preference for each species.

Discussion

The biographic histories have been postulated for *Eumeces e. lividus* (Mount,1965), *Neoseps reynoldsi* (Telford, 1959), and *Rhineura floridana* (Zug, 1968). All of these lizards were believed to have evolved (or survived) through insular isolation. With the exception of *Neoseps*, the patterns of dispersal of these lizards have apparently been altered by intergradation and/or competition with related stocks (ones which have invaded peninsula Florida from the mainland as ancient seas retreated). Nevertheless,these factors alone cannot account for the present-day distribution of these lizards and other factors should be considered.

Rhineura, the lizard most highly adapted for fossorial activities, is less demanding in habitat than either of the burrowing skinks (Zug, 1968; personal observations) and is more tolerant of, and dependent on, soil moisture. Accordingly, this lizard has the largest geographical and ecological range. The many lakes, marshes, river swamps, flatwoods and other wet environments which abound in central Florida do not produce marked ecological barriers for worm lizards as they do for burrowing skinks. In fact, the ecotones of these areas are the preferred haunts of *Rhineura* (personal observations) and possibly the species has distributed itself throughout much of the state by following the fringe areas of these habitats. Since these lizards often confine their activities to these areas in dry seasons, geographic barriers (i.e., rivers) could be crossed in years of prolonged drought by individuals forced into areas of adequate soil moisture which would allow normal burrowing activities.

Compared to the worm lizard, the blue-tailed mole skink and the sand skink have relatively confined geographical and ecological distributions (Fig. 2). *Eumeces e. lividus* occurs only on the Lake Wales Ridge. The Lake Wales Ridge is an ecological

island bordered to the east and west by the Peace and Kissimmee Rivers respectively. Additional barriers to the north and south are formed by the Green Swamp and the upper reaches of the Everglades (Lee and Bostelman, 1969). Because of these barriers, it seems unlikely that moisture-intolerant, burrowing lizards would demonstrate any significant dispersal under present conditions. *Neoseps reynoldsi* is known from the Lake Wales Ridge and four scattered localities to the north (Lake County). It is interesting to note that Lake County is a zone of intergradation between *Eumeces e. lividus* and *E. e. onocrepis* (Mount, 1965).

In several communities (i.e., scrub ecotone and sand-hills) *E. e. lividus*, *N. reynoldsi*, and *R. floridana* occur sympatrically. Furthermore, since all three lizards confine their activities to the top few inches of the soil, it should be mentioned that varying degrees of moisutre toleration would produce an important isolating mechanism. Perhaps this helps in reducing the competition between the three species.

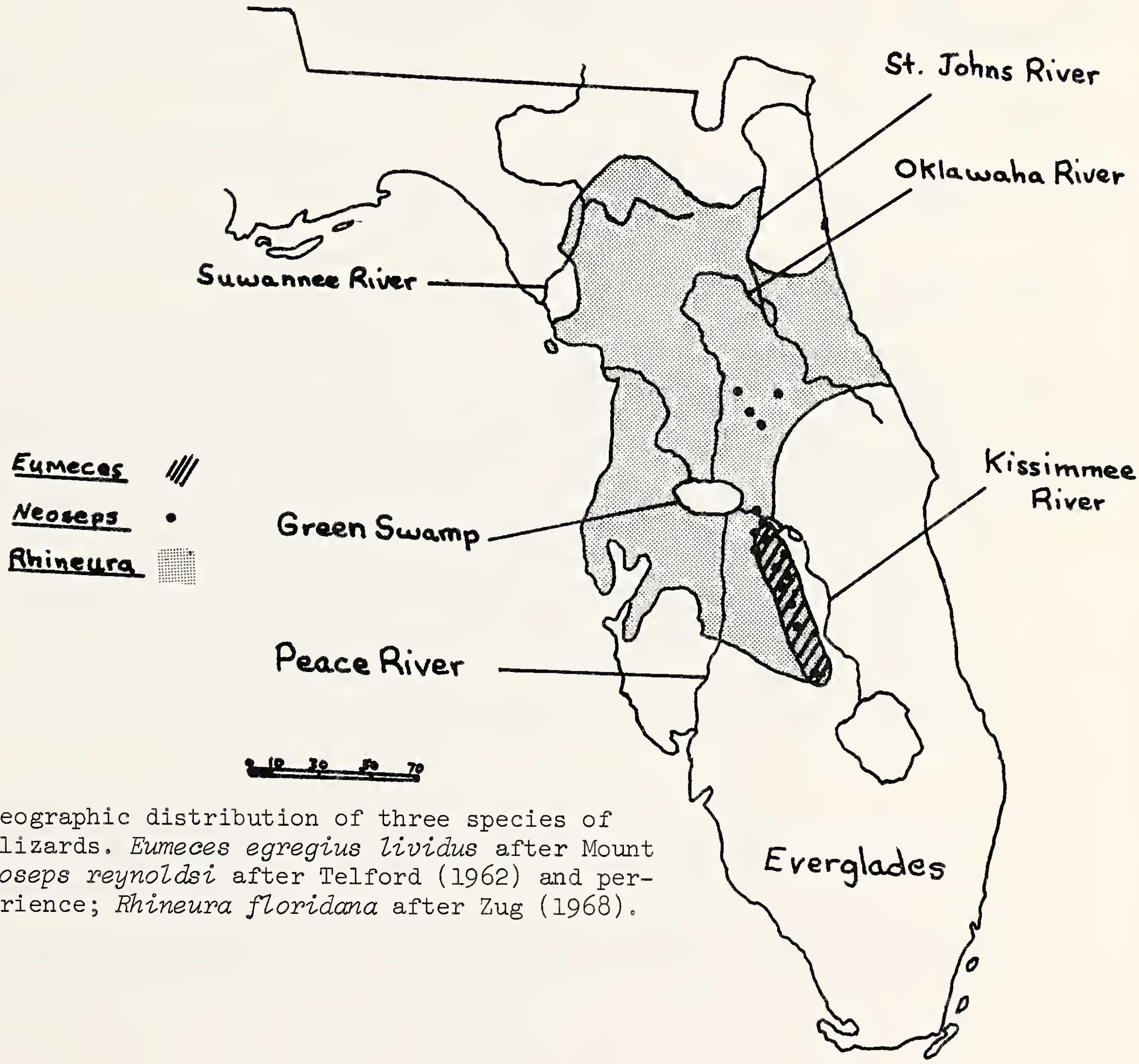

Fig. 2 Geographic distribution of three species of burrowing lizards. *Eumeces egregius lividus* after Mount (1965); *Neoseps reynoldsi* after Telford (1962) and personal experience; *Rhineura floridana* after Zug (1968).

Summary

The present geographic distribution of endemic Floridian herpetofauna can only be partially explained by past biographic undulations. Modern geographic conditions would favor gradual dispersal into the many suitable habitats which are presently uncolonized. Since this dispersal has not occurred, ecological and/or behavioral barriers must be considered. Correlation between the present-day distributions of the three lizards and their moisture tolerance would imply that soil water represents an important limiting factor.

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Notes on *Clemmys guttata* as a scavenger in a Parkville, Maryland pond

On 7 March 1968 Robert Brauer and I visited a pond off of Grove Road, Parkville, Maryland. Approaching the pond on this misty, cool evening we heard large choruses of *Hyla crucifer* and *Rana sylvatica*. We found the surface of the pond was still partially covered with ice.

We observed several pairs of *Ambystoma maculatum*. While working the pond we noticed dozens of *R. sylvatica* and *A. maculatum* carcasses in the water. The air reeked of decaying amphibians. Dissection of several of the dead animals revealed that they had been shot with B-B's.

Brauer and I returned the next night and noticed that several of the carcasses were dismembered, apparently eaten by some animal. After some searching, I discovered several *Clemmys guttata* feeding on the carcasses.

Bruce Manns, *2908 Manns Ave., Baltimore, Maryland 21234.*

A record sized *Desmognathus*

Conant (1958) recorded a specimen of *Desmognathus quadramaculatus* with a total length of 7 3/8 inches (187 mm). We are not aware of any additional information concerning maximum size in this species. During the month of May 1968, the senior author made frequent visits to bait shops in the area of Atlanta, Georga, for the purpose of securing representative species of salamanders for his private collection. Examination of this material revealed that one specimen of *Desmognathus quadramaculatus*, ELK 1841-male, was of record size. This individual measured 96 mm snout-vent length and 193 mm total length prior to preservation. The owner of the bait shop from which this salamander was purchased informed us that the shipment in which it arrived came from Murphy, Cherokee County, North Caroliana. The specimen has been deposited in the collection of Florida Southern College.

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David S. Lee, *20 Linden Terrace, Towson, Maryland.*

The Snakes of Long Island; Supplementary Data, I

Frederick C. Schlauch

This is the first of a series of articles that will be offered as supplements to "The Snakes of Long Island" (Schlauch, 1967). Information concerning noteworthy records not mentioned in that account will appear in this series.

Carphophis amoenus amoenus (Eastern Worm Snake) - Yeaton (1938) found six worm snakes beneath wet boards on the edge of a swamp in Belmont Lake State Park.

Coluber constrictor constrictor (Northern Black Racer) - Latham (1968a) reported that a 58 inch black racer had been attacked by a red-tailed hawk, *Buteo jamaicensis*, on Gardiners Island during April 1918. Burnley (1968) mentioned some records of *C. constrictor* from northern Oyster Bay Township.

Heteredon platyrhinos (Eastern Hognose Snake) - On 27 April 1968, I discovered a female eastern hognose snake 21-1/2 inches long under a sheet of metal in a dump bordering the northern edge of Hempstead Lake State Park. After capture the *Heterdon* regurgitated a partially digested Fowler's toad, *Bufo woodhousei fowleri*. The snake exhibited the puffing and hissing antics associated with this species but did not "play dead." This snake was preserved and deposited in the AMNH collection.

Lampropeltis getulus getulus (Eastern Kingsnake) - Engelhardt *et al* (1915) classified DeKay's (1842) indication that *L. getulus* occurred on Long Island as very doubtful. Although Roy Latham contributed some material to the account by Engelhardt *et al* (1915), he informed me via personal communication that the eastern kingsnake had been found on Long Island and that he considered DeKay's (1842) indication that this snake had been noted on Long Island valid. Latham (pers. comm.) reported that *L. getulus* had been recorded by local residents of eastern Long Island in the region between Riverhead and Quogue, and in the Napeague-Montauk area of Easthampton Township. According to Latham (pers. comm.), *L. getulus* was called the "Sachem Snake" on eastern Long Island. "Sachem" is an Algonquian Indian term and means "the chief." Based on this evidence, I think that the eastern kingsnake occurred on Long Island; however, the kingsnake is apparently extinct or extremely rare on Long Island at the present time. Conant (1958) did not include Long Island in the range of *L. getulus*.

Opheodrys vernalis vernalis (Eastern Smooth Green Snake) - Latham (1968c) reported that he had discovered two astern smooth green snakes under a scrub oak three miles west of Riverhead, on 18 July 1926. An early appearance record was observed on 7 May 1939 between Riverhead and Quogue, and a late appearance record on 18 September 1943 in the Three Mile Harbor area of Easthampton Township (Latham, 1968c). Latham (1968c) also mentioned sight records of *O. vernalis* from south of Fresh Pond (Napeague), near Round Pond (Sag Harbor), and northwest Woods (northeast of Sag Harbor). According to Latham (1968c), there were no records from Southold Township, Shelter Island, or Gardiners Island.

Storeria dekayi dekayi (Northern Brown Snake) - Latham (1968d) reported that the northern brown snake has become the most frequently observed snake in Southold Township.

Storeria occipitomaculata occipitomaculata (Northern Red-bellied Snake) - Yeaton (1938) stated that red-bellied snakes were "...common around Babylon, and have been found in Manorville and Baiting Hollow." Burnley (1968) mentioned that a DOR *S. occipitomaculata* had been seen on Route 25A at Laurel Hollow, Oyster Bay Township, on 28 September 1963. Latham (1968e) stated that this snake "...is extremely rare on eastern Long Island." Latham (1968e) reported records from about two miles west of Sweezy Pond (Riverhead), west of Round Pond (Sag Harbor), and south of the Peconic River (Calverton). Latham (1968e) stated "This snake does not occur on the north fork of Long Island, on Shelter Island, nor on Gardiners Island."

Thamnophis sauritus sauritus (Eastern Ribbon Snake) - Yeaton (1938) stated: "The ribbon snake is found largely in swamps and wet fields and is common in Belmont Lake State Park and throughout the fresh water lowlands along the south shore." Latham (1968b) reported that the eastern ribbon snake was one of the uncommon snakes of the north fork of Long Island but that it had been recorded throughout most of Southold Township. However, it has never been found at Orient (Latham, 1968b). Latham (1968b) gave the following additional information about *T. sauritus*: "In Southold Township, this snake has been seen most often in the Greenport area, where an early appearance record was found on March 10th. Farther west, especially in the Riverhead region, this snake has been found more frequently. My earliest appearance record from this region was also March 10th. I have not found any late appearance records after the month of October."

Thamnophis sirtalis sirtalis (Eastern Garter Snake) - Between 1962 and 1965, I captured several garter snakes at East Meadow, Hempstead Township. On one occasion, I caught a large garter snake in a swampy area bordering a pond located about 1/4 mile west of the junction of County Line Road and the Jericho Turnpike (Route 25) in the vicinity of Woodbury. On 27 April 1968, I caught a *T. sirtalis* (approx. 14 inches long) in the northern section of Hempstead Lake State Park. This snake had been discovered under some wood. It was preserved and deposited in the AMNH collection. Glasser (1968) reported finding two garter snakes at Rockville Centre, and Sickmen (1968) mentioned that *T. sirtalis* had been fairly common in a storage yard behind a fuel oil company at Lynbrook.

Acknowledgement: I wish to thank Mr. Roy Latham, of Orient, Long Island, for information supplied me.

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Another Record for *Cemophora Coccinea* (Blumenbach) in Maryland

Judged on the basis of the number of specimens collected, the scarlet snake, *Cemophora coccinea* (Blumenbach), is the rarest of the snakes reported from Maryland, with the exception of the pine snake, *Pituophis melanoleucus melanoleucus* Daudin.

Fowler (1945, *Proc. Biol. Soc. Wash.*, vol. 58, pp. 89-90) summarizes the records available and notes that the scarlet snake has been reported from six localities in Maryland. The earliest record, according to Fowler, is that of Prof. A. Wyatt, who collected this snake from Baltimore. Another early record is a specimen collected at St. Margarets, Anne Arundel Co., in 1891. Subsequent records include Salisbury, Wicomico County; Brandywine and Lanham in Prince Georges County; St. Denis in Baltimore County; and Severn in Anne Arundel County.

McCauley (1945, *The Reptiles of Maryland and the District of Columbia*, pp. 101-102) makes no mention of the collection of Wyatt and rejects the records from St. Denis and Severn because of the valid objection that they may not have been correctly identified.

The purpose of this note is to add to the above mentioned records by reporting the collection of a single specimen of this snake from Mill Creek, Anne Arundel County, Maryland, on June 8, 1947. This specimen was collected by Dr. Phillip A. Butler of the U. S. Fish and Wildlife Service and is now No. 43 in the collection of the University of Maryland. The tail is two inches long, or 15.3 per cent of the total length.

Summarizing the records of *Cemophora coccinea* in Maryland, we find that a validly identified specimen has been collected in a total of six localities. All of these, with the exception of the Baltimore record of Wyatt in 1862 (Fowler, '45) are located in the Coastal Plain area. The other two records, one near St. Denis and one near Severn by Kelly, Davis, and Robertson (1936, *Snakes of Maryland*, p. 68) are rejected.

It should be noted also that the record from Salisbury apparently represents two different collections. Fowler ('45) bases his note on a specimen collected by J. P. Brown on April 5, 1923. This specimen was at one time, according to Fowler, University of Maryland No. 1. At present, it is no longer in existence at the University and was not in the University collection when it was reorganized by the author in 1943. The record of its original presence, however, was still carried in the files. On the other hand, the record of McCauley is based on a specimen of R. Conant, for which no date of collection is given. The statement of McCauley ('45, p. 101) that, "It has not been taken on the Eastern Shore," is apparently a typographical error, as Salisbury, Wicomico County, is located on the Eastern Shore of Maryland.

--Robert A. Littleford, Dept. Zool., Univ. Maryland, College Park, Maryland.

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The Rattlesnake, *Crotalus horridus*, in the Maryland Piedmont

Crotalus horridus horridus (Linnaeus) has been recorded previously in Maryland only from the mountainous sectors of Frederick, Washington, Allegany and Garrett Counties, in the major physiographic region known as the Appalachian Province, encompassing the minor provinces of the Alleghany Plateau, the Alleghany Ridges, the Cumberland Valley and the Blue Ridge (McCauley, 1945, *Reptiles of Maryland and the District of Columbia,* pub. by author, 135-8). On the basis of information we have been gathering for the last ten years, it can now be reported from two localities in the Piedmont Plateau.

On July 11, 1948, our attention was called to two photographs of a large specimen of *horridus* on the wall of the game warden's cabin at Loch Raven reservoir, Baltimore Co. The warden, Mr. Baker, informed us that the photos were taken in 1946 at the Prettyboy Dam in NW Baltimore Co. This area is in the eastern division of the Piedmont, about 3 miles from the Carroll County border and 4 or 5 miles from the Maryland-Pennsylvania state line. It had been found among rocks on the shore at the base of the dam. It measured approximately 46 inches, somewhat larger than McCauley's 978 mm. maximum for the state (*loc. cit.*, 137). Warden Baker had observed two additional rattlers, both in April, 1948, in the same place.

This was the first acceptable record for *horridus* in the Piedmont of Maryland, and the first record for Baltimore County. Since then, other interesting records from the Prettyboy area have come to light. In 1954, M. E. M. Brown of Reisterstown, Baltimore Co., informed us that he knew of several rattlers that had been taken at the dam site in the three or four years prior to 1954. In July 1954 a snake which had been killed near the dam was brought to the Baltimore Zoo. The collector talked with and showed the snakes to Officer Sherman Pruitt of the Park Police, an amateur naturalist, who identified it as *horridus*, but apparently failed to realize its interest from this locality. On June 20, 1955, we examined the skin of a specimen that had been killed in 1932 on the Baltimore Co.property of Nita K. Schamberger. The skin was of a yellow phase rattler about 3 feet long. Many other substantiating observations have been reported to us. According to the caretaker of the dam area, the majority of rattler reports come from along Spooks Hill Road, and the Prettyboy Dam Road about 2 miles above the dam. The land on both sides of the road is open farmland, but on one side there is a dense woods which runs downhill to the Prettyboy reservoir. There is no doubt that the timber rattlesnake is a rather common snake in this area, as is *Ancistrodon contortrix mokeson.*

The other Piedmont locality from which *horridus* is now known is perhaps more interesting than the first, since it lies just north of Towson, a suburb of Baltimore City. A large female rattler was collected at Overshot Run, which enters the north shore of Loch Raven Reservoir not far from Sunnybrook, Baltimore Co., in the summer of 1952 by Mr. T. S. Fitchett, Jr. It was donated to the Baltimore Zoo on August 11, 1952, where the identification was verified by zoo employees and by Mr. Ron Nowakowski, an amateur herpetologist of Baltimore. While at the Reptile House this snake gave birth to several young (number unknown). Unfortunately the female and young were disposed of and cannot be traced.

Loch Raven and Prettyboy are water-supply reservoirs on the Gunpowder Falls; the latter site is about 12 mi. NW of Loch Raven, which is about 5 or 6 mi. N. of Towson and about 10 mi. from the Baltimore City limits. The nearest previously known Maryland locality was near Thurmont, Frederick County, in the Blue Ridge. There is a hiatus in the distribution of *horridus* through Carroll County, but the species might turn up there after more extensive collecting. The Baltimore County sites may represent relict populations, cut off by human agencies in recent times, since there is evidence that *horridus* was once considerably more widespread in Maryland that at present (McCauley, *op cit,;* and Warden, 1820, *Description statistique, historique et politique des Etats-Unis de L'Amerique septentrionale* . . . Paris, Chez Rey et Gravier).

McCauley predicted the occurrence of *horridus* in the Piedmont, saving (*op.cit*), "It may also occur in the more rugged areas near the northern boundary of Maryland as far east as Harford or Cecil County." As the Loch Raven record has proved, it may also occur in suitable rugged areas somewhat south of the northern boundary. Mr. Fitchett has informed us that he has seen rattlers at a quarry near Texas, Baltimore Co.; and, Mr. Harry Edel, of Baltimore, has told us of rattlers from "Rocks," Harford County.

A specimen of *horridus*, slightly under four feet in length, was collected near the southern end of Kent Island in Queen Anne's Co. by Mr. Edward C. Bradley of Glen Burnie, Maryland. It was captured during July, 1958, in a dry, sandy pine woods. It was sold to Mr. Heru Walmsley, also of Glen Burnie, who now has it alive in his private collection where we were permitted to examine it.

Kent Island lies in the Chesapeake Bay just off the mainland of the Eastern Shore of Maryland, from which it is separated by a narrow tract of shallow, swampy waters of insufficient depth and extent to constitute a faunal barrier, hence the island can be regarded as mainland. It lies within the dry, sandy and flat Outer Coastal Plain, in an area of extensive cultivation.

In view of the fact that the above specimen was collected in a region far out of its known range and habitat in this state, it may well not be a record of natural occurrence. However, rattlers are known to occur in similar situations in southern New Jersey, and the Eastern Shore has been less extensively collected than most other parts of Maryland.

--John E. Cooper, Department of Herpetology, Natural History Society of Maryland and Baltimore City College, and Frank Groves, Baltimore Zoo, Baltimore 17, Maryland.

Reprinted from *Herpetologica* 15:33-34 with their permission. Ed. note: Since the publication of this note in 1959 information has shown that the mentioned record of a specimen of *Crotalus h. horridus* collected on Kent Island, Queen Anne's Co., is invalid. Frank Groves informed me of a specimen found at Timonium when the shopping center was being built.

A Melanistic *Sternotherus odoratus*

Melanism is unknown in most turtles. Barbour and Carr (1940) and Carr (1952) commented on melanistic *Pseudemys*, and Carr (1961) noted this tendency in Pacific *Chelonia*. These reports suggested that this darkening does not become pronounced until relatively late in the individual's life.

On 17 February 1967, Ed Vetter and I collected a large series of young musk turtles, 2 miles N. Citra (US Rt. 301), Alachua Co., Florida. Turtles were collected by raking masses of emergent and floating aquatic vegetation onto shore. In large mats of pennyworts, *Hydrocotyle americanus*, we collected *Sternotherus* along with thirteen other species of reptiles and amphibians.

One musk turtle collected at this site (30 mm in length, sex undetermined) possessed an abundance of black pigment and lacked shell markings as well as many other markings of the soft parts which are characteristic of the first year of growth. The light spots on the dorsal edges of the marginals are obscured by heavy pigment and the plastron's markings are concealed or absent. The marginals and bridge possess only reduced smudges of seal brown. The remaining scutes on the plastron are similarly marked, but here the dark pigment is even more pronounced. The striping on the head is comparatively faint, and greatly reduced. The skin of other individuals collected at this site is gray with faint light spots; on the melanistic specimen the soft parts are glossy black and the spots are not evident. Stripes are not present on the tail.

During the last five years I have collected several hundred musk turtles and hatched numerous clutches of their eggs and this is the only specimen seen with melanistic characteristics. I would conclude that this trait is rare in the species, but because of the variation and normally obscure markings in the adults, it is likely that superficial examination of adult musk turtles has cuased this phenomenon to be overlooked.

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Reproductive Activity, Growth, and Movements of *Ambystoma mabeei* Bishop in North Carolina [1,2]

Jerry D. Hardy

Ambystoma mabeei (Fig. 1), a small, relatively uncommon salamander, is limited in distribution to the coastal plain of North and South Carolina. Since its description in 1928, details of its biology have remained essentially unknown. Jobson (1940) briefly described the larvae and compared them to larvae of *Ambystoma opacum*. Hardy (1969) illustrated eggs and larvae and presented general data on breeding habits of early life history. Dunn (1944), Freytag (1959), Highton (1957), and Tihen (1958) commented on various aspects of adult morphology. Hutchinson (1961) and Newcomer (1968) presented data on physiology, and Bishop (1928), Jobson (1940), and Mosiman and Rabb (1948) briefly described the adult habitat.

Figure 1. Adult *Ambystoma mabeei*
(Picture from Dr. Robert Simmons)

[1]Work on this project was supported, in part, by a grant from the American Society of Ichthyologists and Herpetologists.

[2]Contribution Number 390, Natural Resources Institute, University of Maryland.

In 1948 a population of *Ambystoma mabeei* was discovered by the author in Scotland County, North Carolina. The present paper is limited primarily to observations on reproductive activity, growth, and movements of this population during 1963.

The Study Area

Most of the study area lies on the Laurinberg-Maxton Air Base (now largely abandoned) near the village of Maxton. Observations were also made of a large pond just west of the Air Base on Route 401 several miles north of Laurinberg. The entire region is flat and sandy. Most of the area has been cleared and is presently being utilized for aviation, agricultural and industrial purposes. Extensive stands of pine remain, especially on the Air Base. The Lumber River drains the area and flows, along with its various small branches, through narrow bands of sweetgum-cypress swamp.

The Reproductive Period

Eggs of *Ambystoma mabeei* were found in the study area between February 2 and March 30, 1963, and ripe adults have been found as early as January 19. Larvae were first available in the breeding ponds on February 4, and transformation may have been in progress, at least in one of the ponds, as early as May 5. Transformation was difinitely occurring on May 15, and no larvae were recovered from the ponds on June 1.

In South Carolina both breeding and transformation may occur earlier than at Maxton. Specimens in the Charleston Museum were examined and at least some of the individuals collected in November and December appeared to be fully ripe. Jobson (1940) collected larvae on March 24, 1935, near the coast of South Carolina. The first of these specimens transformed, under laboratory conditions, on April 1, more than one month ahead of the Maxton population observed in 1963.

The Breeding Ponds

Eggs and larvae have been observed in a number of ponds in the breeding area. These ponds differ widely in size and depth, but are otherwise strikingly similar. They are all acidic (pH ca. 4.5); subject, at least occasionally, to complete drying; in or near extensive stands of pine; and normally devoid of fish. The principal ponds studied are described below:

Field Pond (Fig. 2). This pond is located in the center of a large open field surrounded by pine forest. The pond is approximately 40 feet long and 20 feet wide and reached a maximum depth of 4 feet during 1963. It is an artificial pond, and was dug a number of years ago in an unsuccessful attempt to drain the surrounding field. When flooded it becomes the center of a large, shallow lake and may then reach a depth of 7 feet or more. Under severe flood conditions it is invaded by fish, including pickerel, eel, catfish, various sunfishes, golden shiners, and minnows. Although largely subjected to direct sunlight, a small growth of shrubs affords some shade in one corner of the pond.

Trash Pond (Fig. 3). Like Field Pond, Trash Pond is located in an open field and is unshaded except in the vicinity of a single stand of small shrubs. It is small and shallow, reaching a maximum depth of 15 inches, and is littered with paper

and other debris from an adjacent dump. During 1963 female *mabeei* selectively deposited their eggs on water-soaked brown paper, although normal substrate (aquatic vegetation, sticks, pine needles, etc.) was abundant in the pond.

Figure 2. Field Pond

Figure 3. Trash Pond

Woods Pond (Fig. 4). This pond is located in a pine forest and is heavily shaded by both pine and deciduous trees. It is roughly 50 feet square and reaches a maximum depth of 4 feet. Unlike the open field ponds in which the bottom is sand or muck, the bottom of Woods Pond is covered with a thick mat of rotting leaves and pine needles.

Fox Hole Ponds (Fig. 5). In a section of pine forest near Field Pond are a number of old Army fox holes dug during the World War II period. These small, circular openings form ponds which vary from 2 to 6 feet in diameter and fill to a maximum depth of 18 inches. Their bottoms are heavily covered with pine needles.

Figure 4. Woods Pond

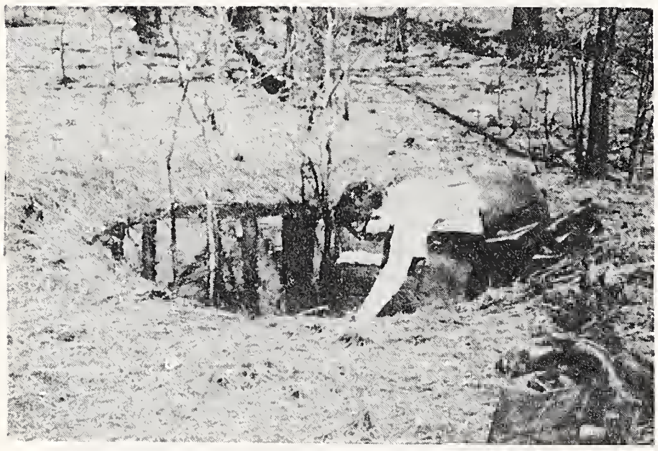

Figure 5. Fox Hole Ponds

Figure 6. Siren Pond

Siren Pond (Fig. 6). Siren Pond (so named because of the large population of *Siren intermedia* which it supports) is a large, shallow, natural lake located near Route 401 a few miles north of Laurinberg. Its size is variable, depending on rainfall, but its basin covers several acres. Its maximum depth may have originally been no more than 3 or 4 feet, but recently channels up to 8 feet deep have been dug in an attempt to convert the lake into a fishing pond. In spite of these channels the lake still dries, especially during autumn. Conversely, during heavy spring rains it may flood and under such conditions may be invaded by large numbers of fishes and turtles.

Emergence Success

During 1963 juveniles emerged successfully from Field Pond and Woods Pond. Although data are not available, emergence also probably occurred in Siren Pond.

Large numbers of eggs were deposited in Trash Pond and larvae were abundant until April 12. By May 5 the pond was reduced to a few very shallow puddles and no larvae were available. By May 15 the pond was completely dry.

The Fox Hole Ponds filled late in the season, and contained eggs in early stages of development on March 30 (the latest data for eggs in any locality). These ponds were dry on May 15. Judging from the small size of the larvae in these ponds on May 5, apparently none of them survived.

These data suggest that emergence success, at least in some years, is directly effected by the drying of the ponds, and that a high percentage of the larvae produced in the Maxton area may not survive.

Growth of the Larvae (Figs. 7 - 10)

During 1963 no larvae were permanently removed from the ponds in the study area. Larvae were measured and released on March 30, April 12, May 5, and May 15. In Field Pond, Trash Pond, and Woods Pond each sample (Figs. 7-9) represents the total number of larvae captured in 10 hauls of a 10-foot minnow seine. One Fox Hole Pond was sampled. In this pond each sample (Fig. 10) represents the total number of specimens obtained in 10 sweeps of a six-inch aquarium net flattened on one side.

These collecting methods undoubtedly resulted in some sampling error. Figure 8 shows a significant increase in the number of specimens obtained in Trash Pond on May 5. This apparent increase may have resulted from escapement of smaller larvae through the seine on March 30. A similar increase in the number of larvae in Woods Pond between April 12 ($n=47$) and May 5($n=51$) is not significant. Specimens 55-60 mm long are assumed to be of transformation size. Some individuals within this size range may have been in the process of transforming. Such specimens would probably be concentrated around the edge of the pond and would not be available using the collecting techniques employed. For the purpose of the present study such specimens are considered a part of the transformed, juvenile population rather than the larval population.

Throughout most of the season a bimodal size distribution was noted in Field Pond, Trash Pond, and Woods Pond. These peaks probably represent two different hatching dates, and reflect two peaks of intense breeding activity.

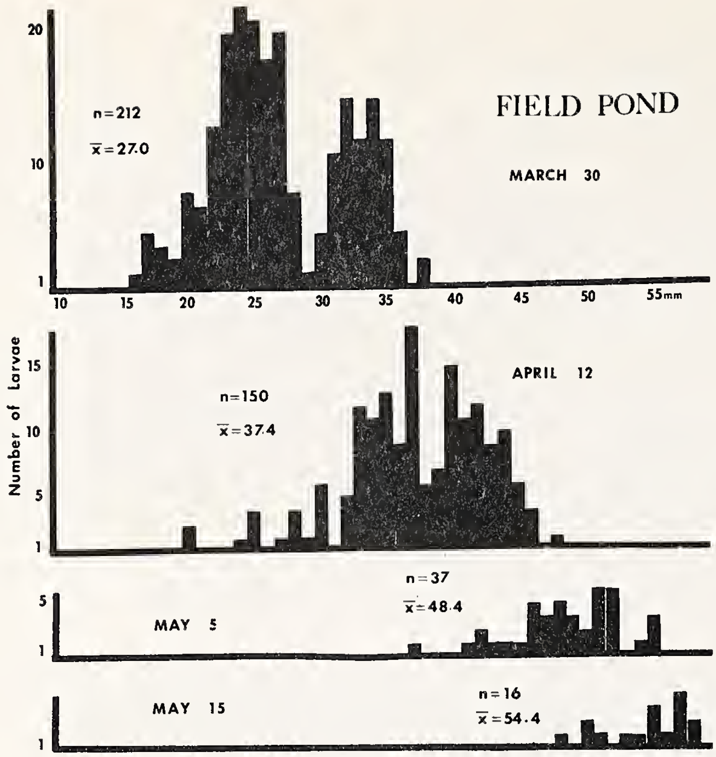

Figure 7. Length frequencies of larvae for Field Pond.

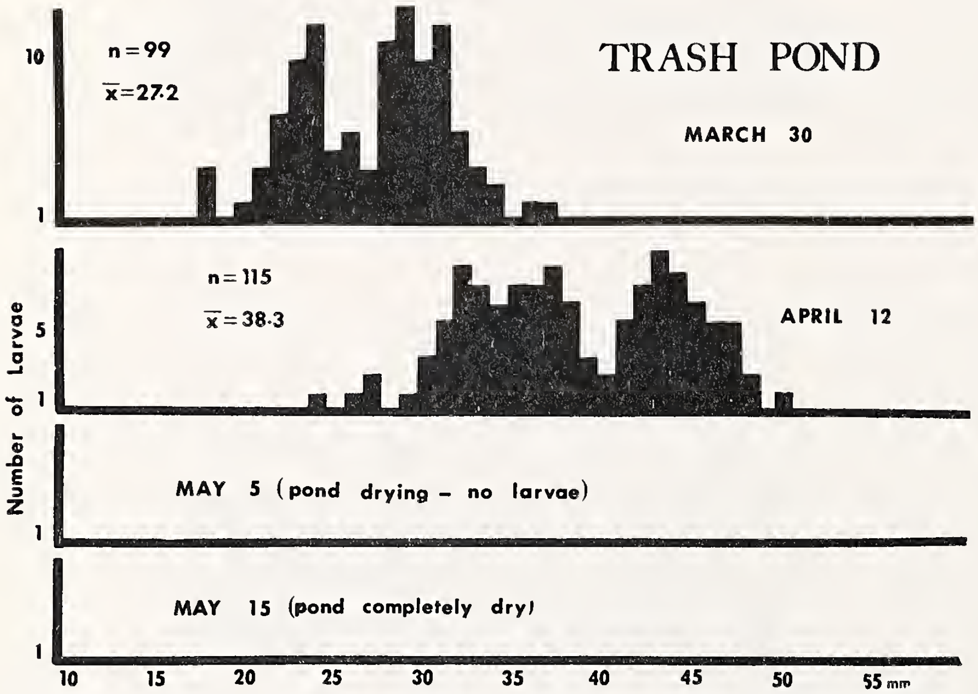

Figure 8. Length frequencies of larvae for Trash Pond.

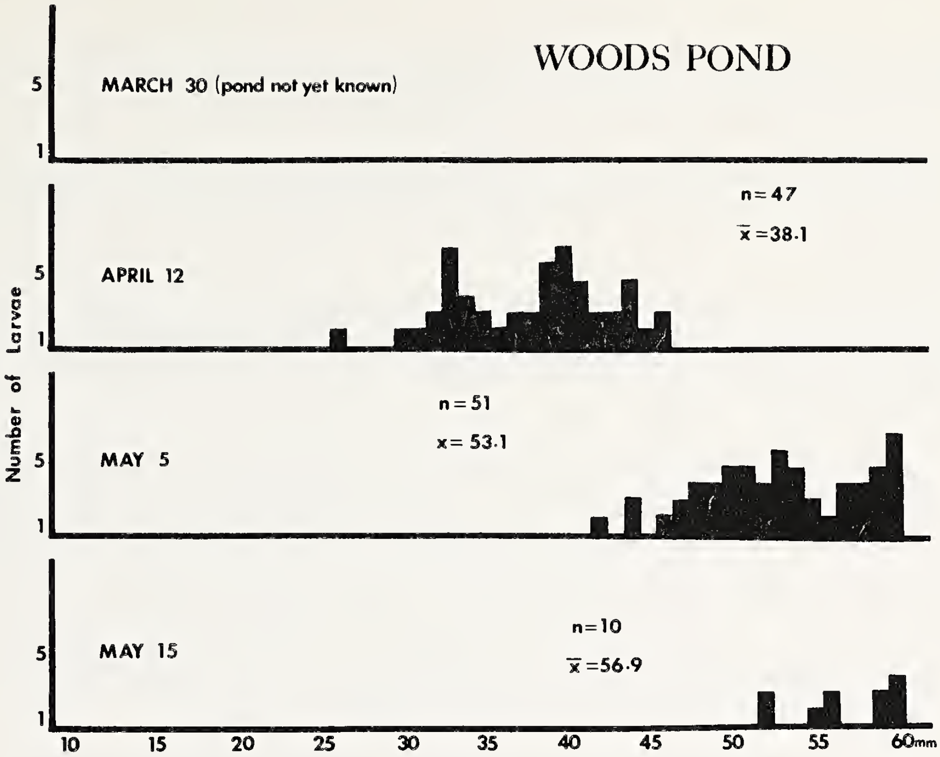

Figure 9. Length frequencies for larvae from Woods Pond.

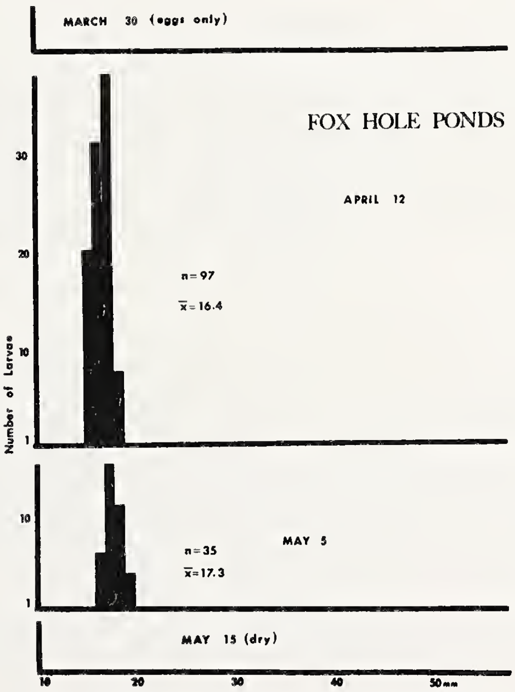

Figure 10. Length frequencies for larvae from Fox Hole Pond.

On March 30 larvae in Field Pond varied from 16-38 mm (mean 27.0) in total length, while those in Trash Pond varied from 18-37 mm (mean 27.2).

On April 12 Field Pond larvae were 20-48 mm long (mean 37.4), Trash Pond larvae were 24-50 mm long (mean 38.3), and the larvae in Woods Pond were 27-47 mm long (mean 38.1).

By May 5 the larvae in Woods Pond were 43-69 mm long (mean 53.1), while those in Field Pond had attained lengths of only 35-55 mm (mean 48.4). The abrupt break in size distribution at 60 mm in Woods Pond larvae suggests that some individuals were transforming or had left the pond by this date.

By May 15 the larvae in Woods Pond were 52-60 mm long (mean 56.9) while those in Field Pond were 48-57 mm long (mean 54.4). Bimodal size distributions were no longer clearly evident, and the population was almost certainly undergoing transformation.

Larvae in the Fox Hole Pond showed only slight (if any) growth between April 12 and May 5. On April 12 they varied from 15-18 mm (mean 16.4) and on May 5, from 16-19 mm (mean 17.3) in total length. This lack of significant growth may reflect the absence of appropriate food organisms in the Fox Hole Ponds.

Larvae in Woods Pond grew more rapidly than those in Field Pond in spite of the fact that Woods Pond was the more shaded and, presumably, cooler of the two ponds. This difference in growth rate may have resulted from an increased abundance of food in the leafy bottom litter of Woods Pond as well as a marked decrease in the number of other vertebrate animals in this pond and a consequent lessening of competition for food.

Predator Pressure

Figure 7 indicates a marked decrease in the number of larvae in Field Pond on May 5. *Mabeei* larvae were recovered from the stomachs of *Ambystoma tigrinum* larvae taken in the pond. *Siren intermedia* also occurs in Field Pond, and large adults of this salamander have been observed feeding on *mabeei* larvae under laboratory conditions. Woods Pond, Trash Pond, and Fox Hold Ponds are free of these predators.

Adult Habitat

There are few published comments on the habitat of adult *mabeei*. The type specimen was tkaen in the low lands adjacent to the Black River at Dunn, North Carolina (Bishop, 1928). Mosiman and Rabb (1948) record it from Tupelo-cypress bottoms in pine woods, and Jobson (1940) found it in cypress and gum swamps. These data, considered collectively, suggest that *mabeei* is restricted to low, wet bottom lands. In the Maxton area the species has been found in a variety of circumstances, but is rarely taken along river bottoms or in swampy lowlands.

Figure 11 summarizes the occurrence of *Ambystoma mabeei* in a variety of habitats in the Maxton area during 1963. These habitats are briefly discussed below:

Open fields. Specimens of *mabeei* were taken from beneath boards and pieces of tin and from old brick piles in open fields from late April to early June. Such

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Open Fields				1	1, 91[1)]	1						
Pine Forest					2	1						
Deciduous Forest					1		1					
Dry Pond Beds								1			2	
Beside Dry Ponds	2	1										
In Filled Ponds		11, 20	7									
Beside Filled Ponds			3		1							
In Migration			76									

1) Juveniles

Figure 11. Annual distribution of *Ambystoma mabeei* in various habitats.

individuals were considerable distances from known breeding ponds and were usually found under extremely xeric conditions.

Pine forest. Specimens were taken in pine forests, particularly around sawdust piles, in early May and late June. These, too, were considerable distances from known breeding ponds.

Deciduous forest. Two specimens were recorded, one in late May and one in early July, in the low, deciduous forest adjacent to river bottoms. These areas are probably similar to the area in which the type specimen was collected and from which Jobson (1940) obtained his specimens.

Dry pond beds. During the autumn drought (from late August to November) adults were found beneath logs and other detritus in the dry bottoms of breeding ponds.

Beside dry ponds. Three specimens were taken in January and February immediately adjacent to ponds which had not yet filled. All of these specimens (one male and two females) appeared to be fully ripe.

In filled ponds. Seining efforts during the 1963 breeding season yielded a total of 38 specimens. All seine hauls were made during daylight hours: No attempts were made to seine at night. Since 1963 no adults have been collected using this technique, although numerous attempts have been made each year. These observations suggest that *ambystoma mabeei* may normally leave the ponds during daylight hours. During 1963 the ponds were never filled to their maximum capacity, and there were considerable accumulations of ice on the ponds during the breeding season. These factors may have caused some modification of normal behavior, and prevented the adults from leaving the ponds.

Beside filled ponds. Spent adults were taken beneath logs, trash, and leaf litter adjacent to filled breeding ponds in late March and late April. Such specimens had invariably been feeding, and were gorged with food, particularly earthworms.

These observations suggest that *Ambystoma mabeei* remains in the vicinity of the breeding ponds throughout most of the year, but may move into open fields, pine forests, and deciduous low-land forest from late May until early July.

Mass Movements

On moderately warm, rainy nights, during the breeding season, both ripe and spent adult *mabeei* may be seen on the ground surface in rather large numbers. In late March, 1963, 76 specimens (including 35 killed by automobiles) were observed along a stretch of highway near the breeding ponds. A number of similar concentrations of adults have been observed in the same area during Feburary and March since 1963. Whether these movements are part of a definite migration or simply a response to temperature and rainfall is not yet known.

On May 30, 1960, 91 recently transformed *mabeei* were collected from beneath boards in an overgrown, tree-shaded lawn adjacent to an open field. No ponds were located in the immediate vicinity, although a shallow depression in the field may have contained water earlier in the spring. The same locality has been visited a

number of times since 1960, particularly during the spring floods, and no obvious breeding ponds have been located within a radius of one-half mile. It may be that these juveniles migrated as a group for a considerable distance from the pond in which they hatched. A similar mass migration of juvenile salamanders away from the parental ponds has been described for *Ambystoma maculatum* (Hardy, 1952).

Summary

In the vicinity of Maxton, North Carolina, *Ambystoma mabeei* breeds from early February until late March. The breeding ponds vary greatly in size, depth, and amount of shading, but are similar in pH, in being subject to severe flooding and drying, in being closely associated with pine forest, and in being normally devoid of fish. In 1963 two of five ponds studied dried completely, and larvae failed to emerge. During the same year larvae grew at slightly different rates in different ponds. These differences may reflect variations in the amount of available food. In at least one of the ponds larvae of *Ambystoma mabeei* were preyed upon by larvae of *Ambystoma tigrinum*.

Adults remain near the breeding ponds except during late spring and early summer at which time they may make excursions into pine forests, deciduous forest, and open fields.

During the breeding season adults become active in response to relatively warm temperatures and rainfall, and may be seen in rather large numbers under these circumstances. There is some evidence that recently transformed juveniles may migrate in groups away from the breeding ponds.

Acknowledgements

I would like to express my most sincere thanks to Mr. John Gillespie of the University of Texas; Mr. Caldwell D. Meyers of Johns Hopkins University; and Mr. Mark Odell of the Natural Resources Institute, University of Maryland, for their valuable assistance in the field during the 1963 survey. I am also greatly indebted to Mr. Archie McLaughlin of Maxton, North Carolina, and to Mr. Fred Currie and Mr. Glen Bingham of Laurel Hill, North Carolina. These individuals not only assisted with the 1963 survey, but provided food, lodging, and transportation on many of my field trips. Mr. Jim Breden of Maxton, North Carolina, led me to the Field Pond and told me of the large numbers of *mabeei* available on the road during late winter rains. His assistance made the location of breeding populations far simpler than it might otherwise have been. Miss. Janet Olmon of the Virginia Institute of Marine Science has assisted on recent field trips. Her carefully recorded observations and almost natural understanding of amphibian behaviour has been most useful in interpreting the 1963 data. Mr. E. Milby Burton of the Charleston Museum, Charleston, South Carolina, allowed me to examine specimens of *mabeei* in the Charleston Museum, and Dr. Julian Harrison of the College of Charleston has provided both specimens and data from South Caroliana. Dr. Ted S. Y. Koo of the Natural Resources Institute, University of Maryland, read the manuscript and offered a number of most valuable suggestions. I would like to also thank Robert S. Simmons for the photograph of *A. mabeei*.

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Chesapeake Biological Laboratory, Solomons, Maryland.

A Unique Feeding Behavior of a Captive Yellow Rat Snake

On 15 October 1968 a yellow rat snake, *Elaphe obsoleta quadrivitta,* two feet in length escaped from its cage. Several hours later this snake was found swallowing a stuffed yellow bat, *Dasypterus floridanus*, which had been prepared as a study skin several weeks before. While preparing study skins of *Dasypterus* I frequently fed other captive rat snakes the skinned, headless carcasses of these bats. Yellow bats frquently roost in dense hanging clumps of Spanish moss which are also frequented by *Elaphe* and therefore it seems likely that these snakes may be well acquainted with this bat. It is interesting, nevertheless, to note that this snake is able to recognize this potential prey under such extreme conditions. It would appear that visual as well as olfactory stimuli both play an important role in the detection of food in this snake.

--Roger A. Sanderson, Florida Southern College, Lakeland, Florida.

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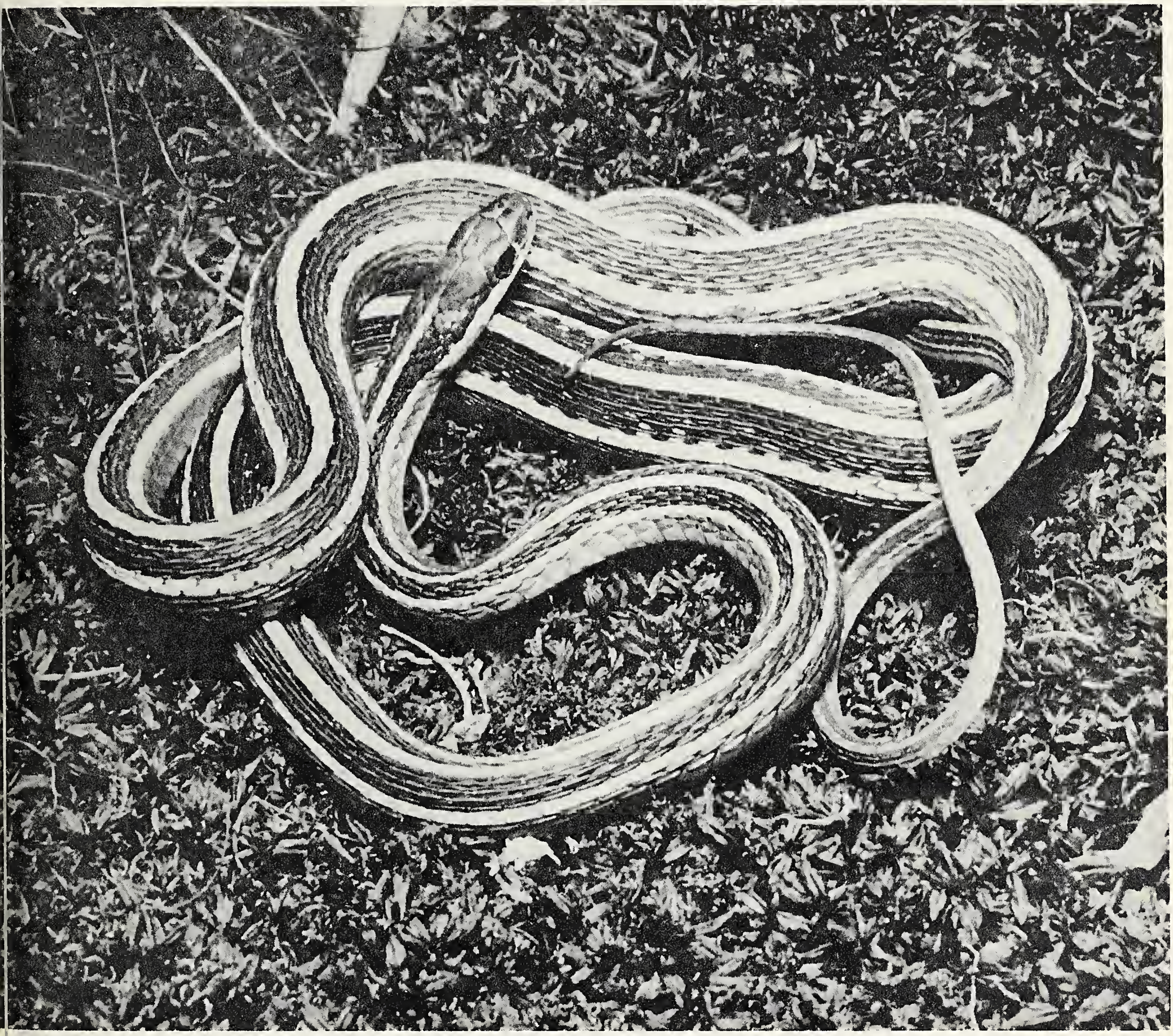

SEPTEMBER 1969 VOLUME 5 , NUMBER 3

Bulletin of the Maryland Herpetological Society

Volume 5 Number 3 September 1969

Contents

The Cover: A *Thamnophis s. sauritus* from Severna Park, Maryland. Photograph by Dr. Robert S. Simmons

Library of Congress Catalog Card Number: 76-93458

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The Maryland Herpetological Society, Department of Herpetology, Natural History Society of Maryland, Inc., 2643 North Charles Street, Baltimore, Maryland 21218.

BULLETIN OF THE

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Volume 5 Number 3 September 1969

The Maryland Herpetological Society
Department of Herpetology, Natural History Society of Maryland, Inc.

Membership Rates

Active members over 18...$10.00, under 18...$6.00, subscribing members (outside a 20 mile radius of Baltimore City)...$3.00, Foreign...$4.00 per year.

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The third Saturday of each month, 9:45 a.m. at the Natural History Society of Maryland (except May-Aug., 8:00 a.m.).

A Comment on the Origin of Display Patterns in Reptiles

The display patterns in Iguanidae and Agamidae are a sequence of movements which simulate nods, bobs and pushups (Carpenter, 1966). The purpose of these activities appear to be the advertisement of characteristic patches of color, and to act as stimulants for the breeding adults. These displays are species-specific (Carpenter, 1966) and represent a behavioral evolution which is probably useful in reproductive isolation. Carpenter (1965), discussing the Cocos Island anole, *Anolis townsendi*, remarked that these displays are undoubtedly a result of isolation and succeeding genetic drift, but he raises the question of how this behavior has arisen in the absence of inter-specific competition. Head movements have also been observed in tortoises (Campbell and Evans, 1967) during their reproductive periods. These displays are frequently accompanied by sounds produced by the male tortoise. Although it is obvious that reptilian displays are now highly specialized, and have evolved on a species level, it appears that the movements of these reptiles may have a more elementary function.

In 1921 Joseph Grinnell wrote a classic work on the principle of "rapid peering" in birds. Although this work received some attention in ornithological literature, it has been practically ignored in other fields. In condensed form, this principle states that birds handicapped by the lack of binocular vision are better able to distinguish immobile objects by rapid movements of the head. It is not clear whether this movement allows stationary objects to be envisioned in relief against a moving background, or if the bird actually achieves a perception of depth. It would appear that the principle of "rapid peering" would be similar to the technique of triangulation used in the calculation of distance. This behavior has recently been noted in flying squirrels, *Glaucomys volans* (Lee, 1968). Walls (1942) pointed out that this behavior is common in a large number of birds and reptiles, but concluded, "the habit does not seem sexual...". Nevertheless, with the exception of Richmond (1952) the effect of "rapid peering" on animal behavior seems to have been ignored by recent students. Kastle (1963, 1965) postulated a very different, yet plausible origin for bobbing displays. Here I would like to make a few comments on this behavior.

It would seem likely that the origin of "nods, bobs and pushups" came from reptiles in reproductive condition trying to distinguish the presence or position of prospective mates and/or challenging males. Auffenberg (1965) showed that cloacal scent was a more important stimulus in attracting the species of South American tortoises, *Geochelone*, to their mates, but that horizontal head movements were used to challenge adult male turtles. Olfaction is weak in the Igunidae (Craigie, 1936; Bellairs and Boyd, 1950; Stebbins, 1948) and therefore it is not surprising that these lizards have relied upon visual methods for distinguishing both challenging males and sexually active females. Consequently, it may have been advantageous for lizards to develop more elaborate displays than tortoises. In view of the protective coloration of many reptiles, the advantage of "rapid peering" would be obvious. Individuals which participated in these activities would not only be able to see mates against protective backgrounds, but they would also attract attention to themselves. The exact sequence of the display, and the sound produced by turtles, or the vivid color on the ventral surface of lizards would probably represent a secondary development in these reptiles.

The location of the eyes (and consequently the lack of binocular vision) on the side of the head has been retained in reptiles because of the advantage of locating prey and predators with a wide angle of vision. The patterns of display have developed because they enabled the species to locate mates, and persisted because they allow the individuals to attract attention to themselves by their movement and the display of breeding colors. In turn these displays have developed into species-specific movements which, in some cases, may aid in reproductive isolation for sympatric species, and as innate releasing mechanisms for sexually active adults.

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---David S. Lee, *20 Linden Terrace, Towson, Maryland.*

A Note Concerning the Presumed Occurrence of *Hyla femoralis* in Maryland

The pine woods tree frog, *Hyla femoralis*, was reported from Battle Creek cypress swamp, Calvert County, Maryland, by Fowler and Orton (1947) on the basis of four specimens ostensibly collected there in 1937 by Dr. Carl L. Hubbs and deposited in the University of Michigan Museum of Zoology (UMMZ 91960). Since this record all subsequent attempts to secure additional specimens or to hear the distinctive call of this southern species have failed, leading to the suspicion that the specimens attributed to Maryland were mislabelled as to locality.

Circumstances which led to the reporting of these specimens of *Hyla femoralis* from Maryland involved correspondence about them with Dr. Norman Hartweg (now deceased) then Curator, Division of Herpetology, University of Michigan Museum of Zoology. In a letter dated November 26, 1946, Dr. Hartweg replied to my letter requesting permission to publish a note about the four specimens in their collection labelled as having been collected in Maryland. In his reply he wrote: "The *Hyla femoralis* were collected by Carl and Laura Hubbs on May 7, 1937. As far as our records go we have no reason to doubt the locality."

In spite of this statement, Dr. Hartweg subsequently seemed to have some doubt concerning the veracity of the locality data. In a letter to Jerry Hardy dated August 6, 1948, about a list of Maryland specimens in the collection of the Museum of Zoology he wrote as follows: "I wish to call attention to *Hyla femoralis*. There is every reason to question the data as given in the list. We have reason to believe that the specimens came from North Carolina and were erroneously entered into the catalogue as coming from Maryland. This, of course, cannot be proved until we get hold of the original data, which should turn up eventually."

Just recently (November, 1968), in connection with the preparation of this note, I wrote to Charles F. Walker at the Museum about these specimens. His reply, while not refuting the comments made by Dr. Hartweg, still the leaves the provenance of these specimens open to question. Dr. Walker wrote: "I have searched Dr. Hubb's notes for 1937 but can find no mention of any amphibians and reptiles, either from the Maryland locality or any other. Later in 1937 he did collect in South Carolina and Georgia well within the range of *Hyla femoralis* but there seems not to be a shred of evidence to associate the frogs with these later collections."

To this I can add the following circumstantial information. In May 1937 the American Society of Ichthyologists and Herpetologists held its annual meeting in Washington, D. C. On May 7 (the date the specimens of *Hyla femoralis* were collected), a field trip was conducted to Zekiah Swamp and the Battle Creek cypress swamp. I happened to be on that trip as was Dr. Hubbs, although I did not actually see the specimens collected. It is, of course, also possible that Dr. Hubbs collected the specimens of *Hyla femoralis* farther south during field work before or after the trip to Battle Creek although the collecting date was the date of the Maryland field trip as pointed out above.

Curiously enough, the only Maryland specimens of another southern species, the rainbow snake (*Abastor erythrogrammus = Farancia e. erytrogramma*), were taken in

July, 1937, and, as pointed out by Cooper (1960), no other specimens were found until July, 1960 -- twenty-three years later to the month -- when a fourth specimen was collected in the same county.

In his note on this specimen, Cooper alludes to *Hyla femoralis* as one of those forms which, like *Abastor*, has long been thought of as a rarity never to be seen again in the state. Now that another specimen of *Abastor* has turned up, who can say that the record for *Hyla femoralis* is not authentic and that other specimens may eventually be discovered not only at Battle Creek but in other suitable habitats in southern Maryland.

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---James A. Fowler, *Director of Education, Henry Ford Museum, Dearborn, Michigan.*

Additions to the Distributional Survey: Maryland and the District of Columbia - III

The revised Distributional Survey is planned for the December 1969 issue; rather than include a long list of additional records then, I am presenting the records at this time:

Allegany County
Clemmys guttata - 3 miles S. Cumberland. Collected by L. R. Franz.

Caroline County
Sternothaerus odoratus- Hog Creek. Collected by Pete Wemple.
Chrysemys rubriventris- Hog Creek. Collected by Pete Wemple.

Dorchester County
Chrysemys rubriventris - Nr. Airey, between Higgins Mill pond and Higgins Mill Dam on Transquaking River. Nov. 1961. Collected by John Norman.

Garrett County
Plethodon r. richmondi - Summit of Elbow Mountain, off Westernport Rd. Collected by Richard Highton.

Rana catesbeiana - New Germany. September 3, 1962. Collected by R. L. Franz.

Kent County

Diadophis p. punctatus/edwardsi - NHSM 1414. YMCA Camp Tockwogh, near the Iriquois Village. Collected by Jerry D. Hardy.

Hemidactylium scutatum - Nr. Massey. Collected by J. Bauman.

Prince George's County

Clemmys insculpta - At intersection of Baltimore-Washington Parkway and Md. Rt. 193. Collected by Pete Wemple.

Queen Anne's County

Pseudotriton r. ruber - Southeast Creek, nr. Price. (JAF 2/22/56) Collected by James A. Fowler.

Talbot County

Eumeces laticeps - Easton, Longwoods, Royal Oak, Tilghman, King's Creek.

Thamnophis s. sauritus - Nr. Easton, D.O.R. on Glebe Road.

Storeria d. dekayi - Nr. Longwoods.

Sternothaerus odoratus - All freshwater streams draining into Wye Mills and Fred A. Von Rivers. Wye Mills, Longwoods, Skipton.

Above Talbot County records courtesy of Mr. Pete Wemple.

Wicomico County

Eumeces laticeps - Off Md. Rt. 347 midway between Quantico and Hebren. June 25. 98 mm snout-vent. Collected by J. Norman.

Worcester County

Pseudotriton m. montanus - 5.2 mi. E. of Snow Hill on Rt. 365 about midway between Spence and public landing. Spring 1968. Collected by Joseph M. Bauman, Jr.

Baltimore County

Chrysemys rubriventris. Arbutus, Maryland. 1 June 1969. Collected by David Lee.

---Herbert S. Harris, Jr., *Department of Herpetology, Natural History Society of Maryland, 2643 North Charles Street, Baltimore, Maryland 21218.*

Captive Snakes Preyed Upon By Fruit Flies

During August 1965 I obtained three adult *Sistrurus miliarius* which were separately housed in gallon jars at Florida Southern College, Lakeland, Florida. Crumpled paper towels and small water dishes were placed in each jar. Upon examination after a 10 day period, I noted that the towels were moist and two of the snakes were badly blistered. After killing these snakes and preparing them for preservation, it was noted that several of the blisters contained small maggots. Dissection of one snake revealed that a small number of the maggots had eaten through the skin and were living in the body cavity. No flies were seen in the jars, but many additional maggots were found on the paper towels.

Live maggots were cultured on *Drosophila* medium and on a dead frog, *Hyla squirella*, and left in a tightly sealed jar. Only seven of approximately fifty maggots placed on the *Drosophila* medium pupated, while approximately 75 of a similar number, placed on the dead frog pupated and transformed. Examination of the adult flies revealed that they were a species of *Drosophila* which was later identified as *D. hydei* Sturtevant.

Since this time I have seen this fly on reptiles (*Pseudemys*, *Natrix*, and *Elaphe*) which died in captivity. Whether or not fly eggs or maggots were present before the animals died is unknown. On other occasions I have seen maggots and adult flies in containers which were used for incubation of reptile eggs (*Malaclemmys*, *Sceloporus*, *Heterodon*, and *Elaphe*). Although these eggs contained developing embryos, they failed to hatch. Actual damage which may have been caused by *Drosophila* to these eggs could not be determined, for there was no evidence that the maggots had penetrated the shells.

The carnivorous and carrion feeding habits of this fly are further indicated by trapping methods. Decaying fruit, a bait which is satisfactory in attracting other species of *Drosophila*, does not appeal to *D. hydei*, while a dead animal or decaying meat usually attracts this species. Dr. John Funderburg, who has succeeded in maintaining populations of this fly under captive conditions, informs me that he had difficulty adapting this insect to standard *Drosophila* medium.

It is unlikely that *Drosophila hydei* preys on healthy snakes living under natural conditions since their daily activities, i.e., sunning, etc. would discourage the development of fruit flies. It appears that the maggots of these flies thrive only in a relatively cool, moist environment and therefore predation would occur only under conditions which were extremely unfavorable for the host.

I would like to thank Drs. John B. Funderburg and W. W. Wirth for identification of the flies.

---David S. Lee, *20 Linden Terrace, Towson, Maryland.*

Salamanders in an Alabama Cave

Eudy cave is located in northern Alabama, 6 miles NW of Eddy, Marshall County. This cave is interesting from a biological standpoint since five species of salamanders have been observed there: *Plethodon glutinosus, Eurycea lucifuga, Eurycea longicauda, Pseudotriton ruber,* and *Gyrinophilus porphyritious*.

In the twilight region numerous *E. lucifuga* and *P. glutinosus* have been observed on the floor and in the cracks and crevices of the walls. Fifty yards past the twilight zone *P. ruber, E. lucifuca* and *E. longicauda* have been collected on the floor and walls of the cave. The cave contains a flowing stream which varies in depth from two inches to four feet. In five visits (1 April, 23 April, 20 May, 28 June 1967 and 12 February 1968) to the cave approximately thirty larval specimens of *Gyrinophilus* have been observed. One large larval *Gyrinophilus* was observed on three different occasions (23 April, 20 May and 28 June 1967) in a confined, irregular pool of one to four feet in depth. This *Gyrinophilus* (total length of 142 mm), captured on 28 June 1967 was the largest captured or seen in Eudy cave. To this date only larval specimens of *Gyrinophilus* have been seen.

These specimens of *G. porphyriticus* represent the first record of this salamander in Marshall County caves. This cave is one of the six caves in Alabama now known to contain *G. porphyriticus* (Cooper 68).

Specimens of the species mentioned have been deposited in the museums of Florida Souther College and Memphis State University. I would like to thank Alfred E. Perry for his assistance in the field.

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---E. Leslie Knight, *Science Department, Wingate College, Wingate, North Carolina.*

Possible Circadian Rhythm in the Cave Salamander *Haideotriton wallacei*

David S. Lee

Recent studies have been made on diurnal as well as annual patterns of activity in cavernicolus organisms. Annual reproduction and/or molting cycles have been established in several cave animals: the crayfish *Orconectes pellucidus* (Jegla, 1966), the cave fish *Amblyopsis spelaea* (Polson, 1960) and *Niphargus orcinus*, a blind amphipod from France (Ginet, 1960). These studies suggest that gradual changes in organic material in the water, and annual floods could act to synchronize or modify the cycles, but often no qualitative data could be established. Ginet (1960) believed that in *Niphargus* an endogenous rhythm of reproduction might be present which is not directly correlated to fluctuations of the environment.

Reproductive variations which are not seasonal have been noted throughout the year in terrestrial, ovigerous female cave-dwelling beetles of the sub-families Bathysciinae and Trechinae (Deleurance and Deleurance, 1964). Likewise, recently pupated beetles, *Rhadine subterranea,* found throughout the year suggest a seasonal reproduction to be absent in this species (Mitchell, 1965). The lack of reproductive cycles in terrestrial cave-dwelling beetles and the presence of these rhythms in troglobitic aquatic organisms indicated that the latter are simply reacting to slight changes in the cave environment, such as temperature, chemistry, or depth of the water. Nevertheless, sufficient data to confirm this belief are not available at this time.

Experiments and field observations on the daily activities of *Eurycea lucifuga* and *E. longicauda* produced various conclusions (Park, 1941; Mohr, 1944; Sinclair, 1950; Hutchison, 1958). Early studies on the cave crayfish *Orconectes pellucidus* (Park, et al, 1941) indicated little preference in periods of activity, while reexamination of these same data (Brown, 1961) established a statistically significant rhythm of activity in the species. Here I will illustrate what I believe to be the second recorded example of a cave organism, one which has been removed from daylight for uncounted generations, in which a circadian rhythm persists.

Nine young and sub-adult *Haideotriton wallacei* (24-55 mm total length) were kept in a 20-gallon aquarium. Timing of their activities was begun after they were allowed 18 days to acclimate. Several small pieces of limestone were scattered on the slate floor of the aquarium. The water temperature remained at 19°C throughout the acclimation period and the three week duration of this study. The aquarium was artificially lighted 24 hours/day (i.e., a 12.5 watt bulb positioned 24 inches above the water), since it was impractical to observe the salamanders in complete darkness. Ideally, the activities of these salamanders should have been tested in both darkness and light. Salamander activity was measured by use of a stop watch and forward movement was recorded to the nearest 1/100 second. At the termination of the experiment, the salamanders had been watched for 8 five-minute periods for each hour of a 24 hour day; these 8 observation periods to each hour were randomly selected throughout the 3-week study period. Individual locomotor activity was calculated to percentage of movement per hour. Average activity was plotted for 3 hour periods. Unfortunately, this random method of observation makes it impractical to assess the data statistically.

The salamanders were collected 7 and 8 April 1968, from Gerard's Cave, Jackson County, Florida, by E. L. Knight and myself. On this visit and on other occasions activity patterns of wild salamanders were timed similarly to the method described above. These data, although incomplete, correlated favorably with observations on captive individuals.

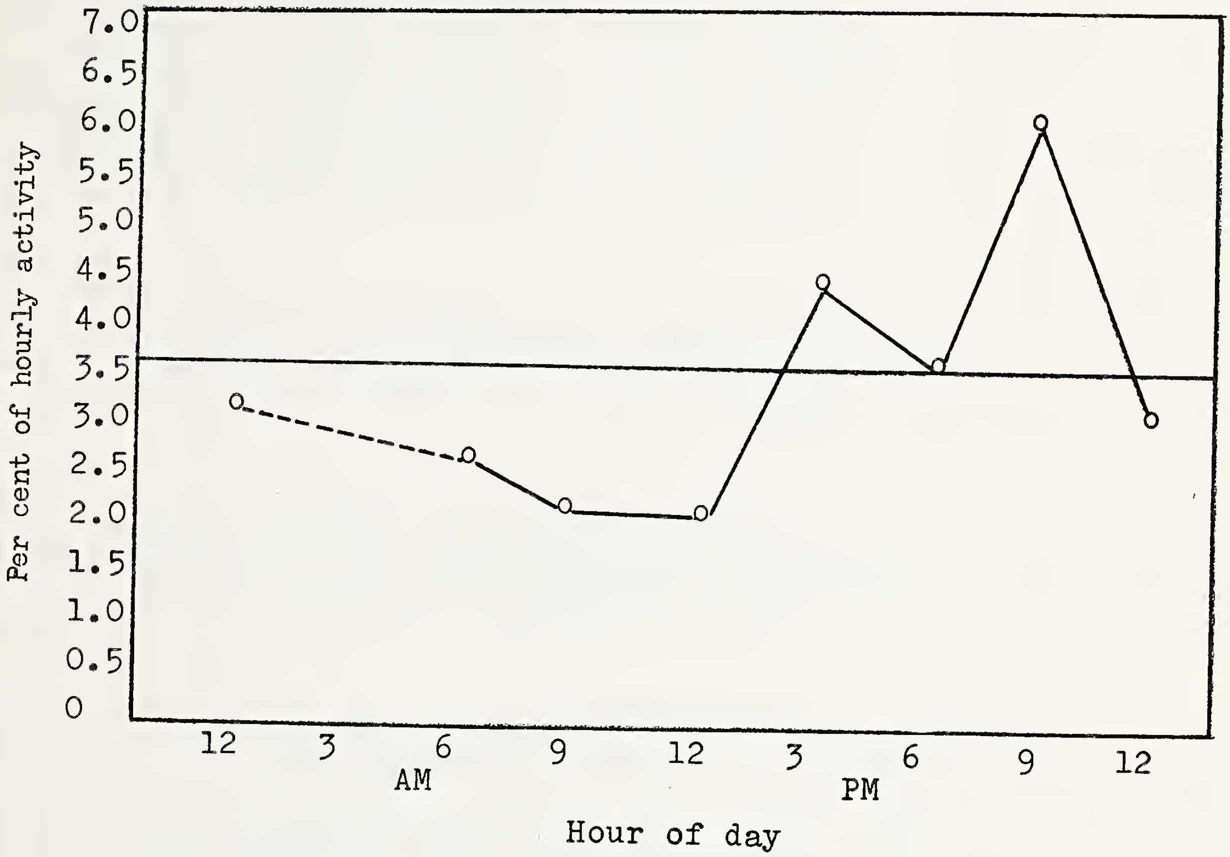

Fig. 1 Circadian rhythm of locomotor activity in *Haideotriton wallacei*. Relationship between hour of the day and percentage of average individual activity for each three hour time period is shown above. Mean of daily activity indicated by horizontal line. The 1:30 to 4:30 a.m. time period was not calculated.

The pattern of maximum and minimum activity is similar, although not identical, to that shown by Brown (1961) for *O. pellucidus*. Maximum activity was reached between 7:30 and 10:30 p.m. (6.3%) while minimal activity appeared between 10:30 a.m. and 1:30 p.m. (2.2%). The highest individual activities, 20.6 and 19.4% were

recorded at 7:00 a.m. and 9:00 p.m. respectively. During all time periods, some individuals failed to show activity. Average individual daily movement was found to be 3.58%. The fact that individual activity, in many cases, did not follow the total pattern suggests errors in observations of a heterogeneous group of individuals. Nevertheless, the activity patterns suggested in this manuscript were somewhat substantiated during a recent food study of *Haideotriton* (Lee, 1969) were fluctuations in stomach contents correspond approximately to their assumed patterns of activity.

In an attempt made to determine the time of feeding of *Haideotriton*, the time of collection and preservation of each of 32 salamanders was recorded in the field. Specimens of *Haideotriton* with undigested and/or partially digested food found in their stomachs were considered to have recently fed. I have divided my collecting data into three time periods: afternoon, night and morning. The actual preservation times for each period range from 1:00-5:30 p.m., 8:00 p.m.-12:00 midnight and 7:00-8:30 a.m. respectively. Of 16 individuals collected in the first time period, 18.8% had recently fed; of the 12 collected int he second period 58.3% had recently fed and in the third period 3 of 4 individuals (75.0%) had recently fed. (The latter sample is admittedly small.)

Daily patterns of activity of *Haideotriton* were apparently established in the surface dwelling ancestors before they attained their subterranean adaptations. The suggestion of this behavior in organisms found in environments of seemingly unvarying light and temperature supports the theory that diurnal rhythms are possibly phased-locked to geophysical factors.

The study of circadian rhythm has become very sophisticated, and thus the information presented here should only be regarded as preliminary. However, it does appear that a daily pattern of locomotor activity does exist, and the precise calculation of this rhythm should not be difficult to obtain.

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Jefferson's Salamander in Maryland

M. Graham Netting

My friend Romeo Mansueti has generously called my attention to the fact that five Carnegie Museum specimens of *Ambystoma jeffersonianum* (Green) from Allegany County are the only preserved Maryland specimens of this species. He has insisted, furthermore, that I prepare a note upon these specimens from Maryland.

Ambystoma jeffersonianum was first reported from Maryland by Brady in his list of the reptiles and amphibians of Plummers Island, Montgomery County (1937, Proc. Biol. Soc. Washington, 50:137). His entire statement with reference to the species was: "Breeds in the ponds in February. Known from eggs only on the property." More recently, Fowler included *A. jeffersonianum* in his list of "The Amphibians and Reptiles of the National Capital Parks and the District of Columbia Region." Mr. Fowler has informed me by letter (March 2, 1946) that this inclusion of the species was based soley upon Brady's record. Although the egg masses of *jeffersonianum* are usually quite distinct in appearance from those of *maculatum*, confirmation of this record by the collection of larvae or adults upon Plummers Island appears desirable.

In the late 1930's Mr. Leonard Llewellyn, then situated at Swanton, donated to the Carnegie Museum numerous Allegany County specimens. On April 3, 1937, he collected at Carlos one adult male *jeffersonianum* (CM 12912), with a snout-to-vent length of 81 mm. Carlos is situated near the western border of Allegany County, three miles SSE of Frostburg, at an altitude of about 2,000 feet. The area is drained by Georges Creek, an affluent of the North Branch of the Potomac River. Mr. Llewellyn reported that in 1937 *A. maculatum*, which was common at the same locality, remained in the ponds much later than usual, but subsequent search yielded no more Jefferson's salamanders.

Mr. Llewellyn had greater success in 1938. On the evening of March 12 he collected four specimens "coming down through field to pond" at Carlos. Three of these were sent to the Carnegie Museum; two are adult females (CM 13687-88) with snout-to-vent lengths of 94 and 88 mm., respectively; and one is an adult male (CM 13689) with a snout-to-vent length of 80 mm. On March 19 he collected three specimens in the pond, of which one (CM 13691) reached our collection. This specimen, an adult female with a snout-to-vent length of 88 mm. and a total length of 176 mm., has now been sent to the Natural History Society of Maryland on exchange, and bears the number NHSM-A910.

The Allegany County specimens are characteristic of the large type of *jeffersonianum* that is widespread in Pennsylvania and eastern West Virginia. Of the five specimens listed here, the three with damaged or regenerated tails range from 131 to 155 mm. in total length; the two with perfect tails, a male and a female, measure 159 and 176 mm., respectively. These measurements are not remarkable for *jeffersonianum* from the Alleghenies, but they are notably greater than those of the small, dark, heavily blue-spotted type of *jeffersonianum* that ranges from western New York to the Middle West. Bishop (1943, Handbook of Salamanders:134) states that ten mature individuals of the latter type from western New York average 115.7 mm. in length. Determination of the exact status of this northern or dwarf *"jeffersonianum"* is a problem that merits careful study.

Curator of Herpetology, Carnegie Museum

Reprinted from Maryland XVI(3):6061. with the permission of the Natural History Society of Maryland. Ed. Note: Since the publication of this note in July 1946 much additional information has been obtained. See Bull. Md. Herp. Soc. 2(2):8-9 and 3(1):19-22.

Notes on Migrating *Ambystoma maculatum* in Howard County, Maryland

Ambystoma maculatum is known to migrate to its breeding ponds in the early spring (Noble, 1931). One locality where this can be observed is Patapasco State Park in Howard County, Maryland. The pond is adjacent to River Road, three tenths mi. N of intersection with Gun Road. The locality is unique since the salamanders must migrate across River Road to reach the breeding pond.

On 17 March 1968, a migration of *A. maculatum* was observed. The air temperature was 55 F. The high for the previous day was 65 F. The humidity, at the time of collection was 100%. There had been heavy rain from 10:30 PM the previous evening.

The area studied was a short stretch of River Road adjacent to the pond, from .25 to .45 mi. N of the intersection. The .2 mi. stretch was collected four times in a half hour period (12:30 AM - 1:00 AM). The headlights of the automoble driven were used to illuminate the area so that the salamanders could be seen crossing the road. All specimens observed were classified by sex and were measured from snout to anal slit (posterior end).

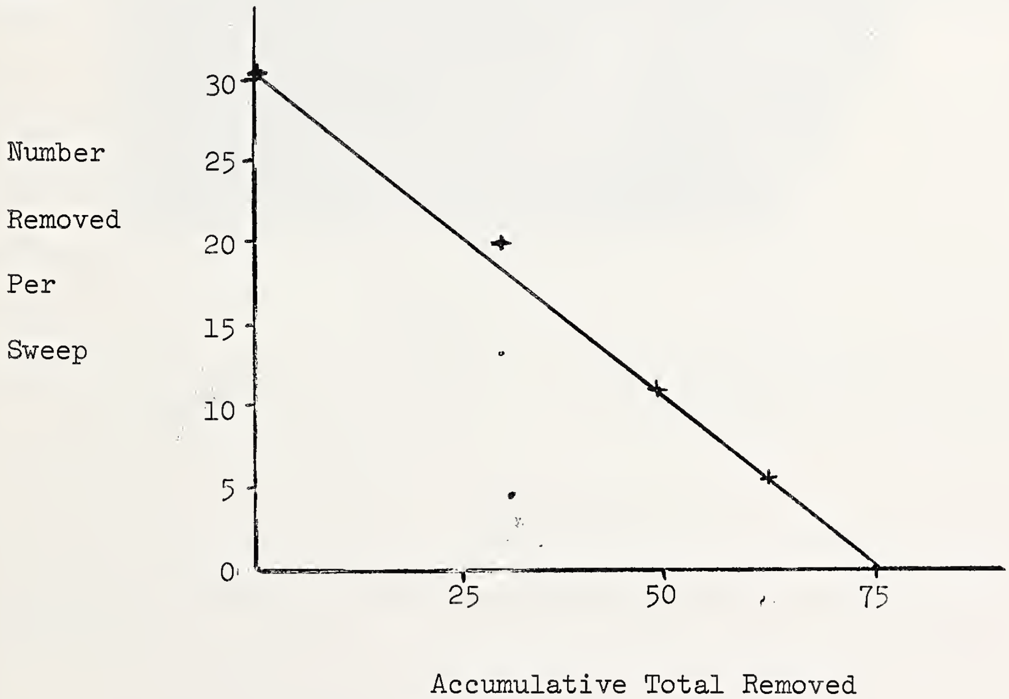
A total of 66 *A.maculatum* were measured during the half hour period. There were 54 males and 12 females. The capture data per sweep is shown in Figure 1. The ratio of males to females is 4.3 males per female.

	1	2	3	4	total
males	25	14	10	5	54
females	5	5	1	1	12
total	30	19	11	6	66

Fig. 1: Number of specimens per sweep.

An estimate of the total number of *A. maculatum* that were crossing the road during this time period was obtained by plotting the number of specimens removed per sweep versus the total number removed (Odum, 1963), Figure 2.

Figure 2: Estimate of total number of specimens.



By projecting a line through the points (Fig. 2), an estimate of the number of salamanders crossing in that half hour was approximately 76.

The specimens were examined to see if there were any differences in the snout-anal slit measurement between males and females (Fig. 3).

Sex	Range	Average Length
males (54)	67mm-92mm	85mm
females (12)	83mm-102mm	94mm

Fig. 3: Table of measurements of *A. maculatum*

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---David W. Saul, *1404 Haubert St., Baltimore, Md. 21230.*

Records of the Leatherback Turtle, *Dermochelys coriacea coriacea* (Linnaeus), from the Chesapeake Bay.[1]

Jerry D. Hardy

Three recent reviewers of the Virginia and Maryland turtle faunas have commented on the occurrence of the leatherback turtle, *Dermochelys coriacea coriacea*, in Chesapeake Bay. Virginia Herpetological Society (1968) cites no authentic Virginia records, but states that *Dermochelys* may have been observed near the mouth of the Bay at Newport News or Hampton. Cooper (1965) points out that the species occurs in Chesapeake Bay, but comments that there are "no definite Maryland records". Schwartz (1961, 1967) presents an excellent description of *Dermochelys*, but gives no data on its distribution in Maryland.

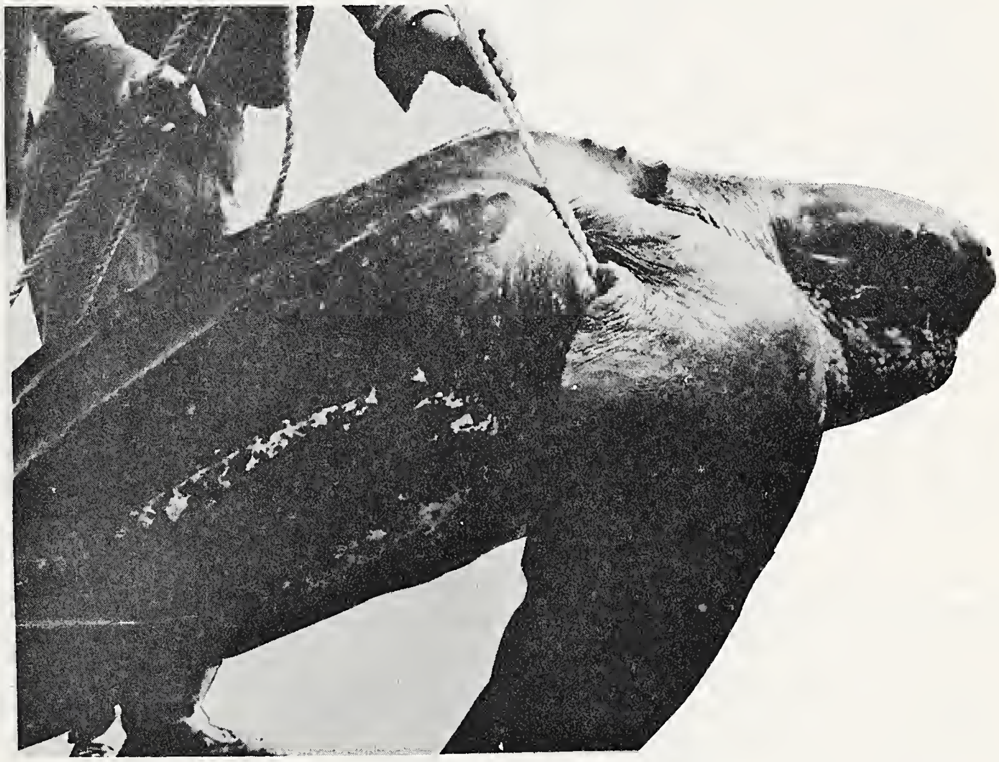

Figure 1. *Dermochelys c. coriacea* from Dorchester County, Maryland. (Photograph by Andrew Misulia).

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[1]Contribution Number 393 of the Natural Resources Institute of the University of Maryland.

A recent survey of literature dealing with the distribution of *Dermochelys* has revealed the fact that this species has been recorded in the Chesapeake Bay a number of times. The purpose of the present note is to summarize existing historic and recent records, and to present data on a specimen captured in the Bay in 1967 (Fig. 1).

Carr (1952) points out that the first specimen of *Dermochelys* recorded from United States waters was captured in Chesapeake Bay in 1811. A specimen taken in the Bay in 1840 was described and illustrated by Holbrook (1842), and subsequently commented upon by DeKay (1842) and Ford (1879). Agassiz (1857) and McCauley (1945) state that *Dermochelys* occurs in the Chesapeake, but cite no specific records. Skeletal remains of two Chesapeake specimens are catalogued in the collection of the United States National Museum (USNM 029492, USNM 029482), but neither of these is accompanied by exact data.

There are two well-documented records of *Dermochelys* from Virginia waters of Chesapeake Bay. Ford (op. cit.) records a specimen from Gloucester Point, Gloucester County, collected in 1879 (Fig. 2a). Reed (1957a, 1957b) describes and illustrates a 700-pound specimen captured 2 miles southeast of Great Wicomico Light House near Fairfax during May or June, 1952 (Fig. 2b). Three specimens have been recorded from Maryland waters of the Bay. Maryland Conservationist (1932) records a 1,100-pound specimen captured between Little Cove Point, Calvert County, and Barren Island, Dorchester County, on June 3, 1932 (Fig. 2c). Hardy and Mansueti (1962) comment on two specimens which washed ashore in Calvert County: One at Little Cove Point on September 14, 1934 (Fig. 2d), and one at Dares Beach on June 24, 1947 (Fig. 2e).

On or about July 15, 1967, Mr. Charles Parks, of Wingate, Maryland, captured a leatherback turtle in Hooper Strait near the lower end of Hooper Island, Dorchester County, Maryland (Fig. 2f). It was taken to the U. S. Bureau of Commercial Fisheries Laboratory at Oxford, Maryland, and placed in a small pond. Several days later it died and was burried at the Laboratory. A recent attempt to recover the skeleton was unsuccessful. Various individuals at Wingate and Oxford estimated the live weight of this specimen as 600 or 650 pounds.

These records demonstrate that *Dermochelys coriacea*, a typically pelagic, oceanic turtle, enters the Chesapeake Bay, at least occasionally, and has been observed as far north in the Bay as Dares Beach, Calvert County, where the salinity is normally about one half that of pure sea water. Available records show that it enters the Bay at least as early as June 3, and may be found in the Bay up until September 15. *Dermochelys* is known to make extensive northward excursions during the summer months, and has been recorded a number of times along the seaside of the mid-Atlantic States (see, for example, Mitchill, 1911, and Ford, op. cit., for New Jersey and Delaware records, and McCauley, op. cit., and Jones, 1968, for Virginia seaside records). Individuals moving northward close inshore along the Atlantic coast probably enter Chesapeake Bay essentially by chance, do not remain in the Bay for extended periods of time, and do not penetrate its waters into regions of low salinity.

Figure 2. Distribution of *Dermochelys c. coriacea* in Chesapeake Bay. Letters are keyed to localities mentioned in the text.

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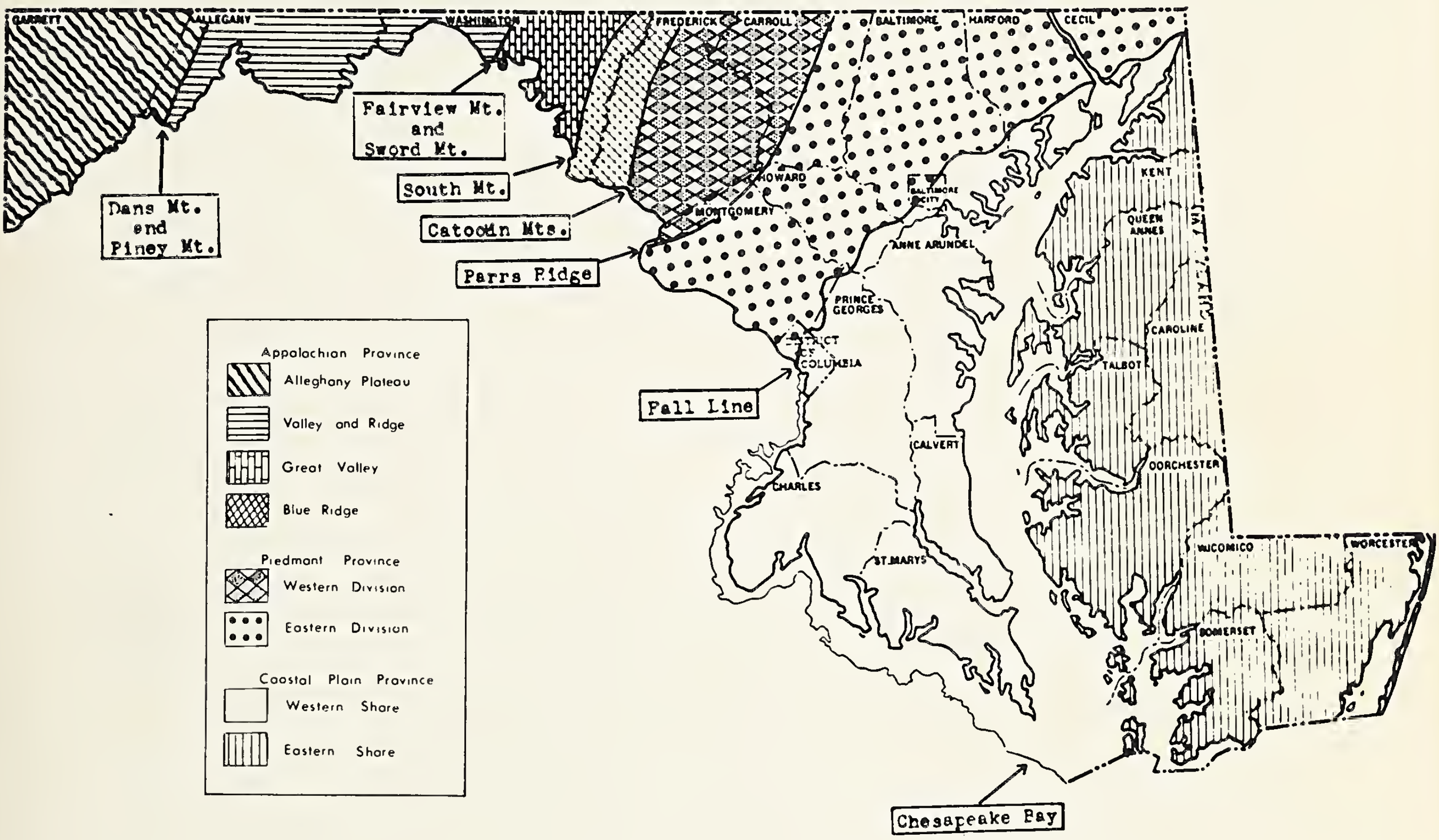

Distributional Survey: Maryland and the District of Columbia

DECEMBER 1969 VOLUME 5 , NUMBER 4

Bulletin of the Maryland Herpetological Society
Volume 5 Number 4 December 1969

Contents

Library of Congress Catalog Card Number: 76-93458

The Cover: Map of Maryland showing the physiographic provinces. Courtesy of Dr. Charles J. Stine.

Ed. note: Manuscripts being submitted for publication should be typewritten (double spaced) on good quality 8 1/2 by 11 inch paper, with adequate margins. Submit original and first carbon, retaining the second carbon. Indicate where illustrations or photographs are to appear in text. Cite all literature used at the end in alphabetical order by author. Reprints are available at $.01 a page ($.02 a page with photographs) and should be ordered when manuscripts are sent in. Minimum order 100 reprints.

The Maryland Herpetological Society, Department of Herpetology, Natural History Society of Maryland, Inc., 2643 North Charles Street, Baltimore, Maryland 21218.

Errata

Page 100 , *sylvantica* should read *sylvatica* ; *septemvittata* should read *septemvittata*

Cemophora coccinea copei = *Cemophora coccinea coccinea* and *Cemophora coccinea* as listed by author in error!

Lampropeltis triangulum triangulum = *Lampropeltis doliata triangulum*

Lampropeltis triangulum temporalis = *Lampropeltis doliata temporalis*

Malaclemys geographica = *Graptemys geographica*

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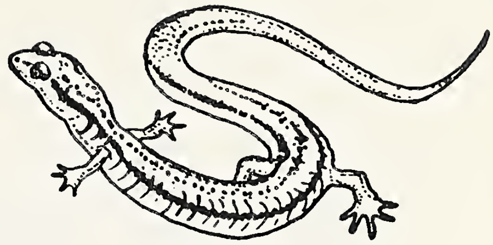

Volume 5 Number 4 December 1969

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Distributional Survey: Maryland and the District of Columbia

Herbert S. Harris, Jr.

Cooper (1960) presented the first report on the combined physiographic and county distribution of the amphibians and reptiles of Maryland and the District of Columbia. Previously, only McCauley's (1945) work on reptiles of this region was available. Cooper's (1960) paper was reprinted and revised by Harris (Cooper,1965) in November 1965. Since then, at the end of each year, the survey was brought up-to-date by "Additions to the Distributional Survey of Maryland and the District of Columbia" published in the Bulletin of the Maryland Herpetological Society.

County and physiographic records, in some instances, are misleading. Consequently, it was decided to revise the survey and to include annotated maps showing the known distribution of the amphibians and reptiles within the state.

Maryland, including the District of Columbia, is bounded on the north by Pennsylvania, on the east by Delaware and the Atlantic Ocean, on the south by the Potomac River (West Virginia, Virginia) and on the west by West Virginia. From sea level (Atlantic Ocean) the topography rises to 3,340 feet (Backbone Mountain). The total area of the state is 12,327 square miles, of which 2,386 square miles are water. The state is divided into three major physiographic provinces with eight recognizable divisions:

Appalachian Province
1. Alleghany Plateau
2. Valley and Ridge
3. Great Valley
4. Blue Ridge

Piedmont Province
5. Western Division
6. Eastern Division

Coastal Plain Province
7. Western Shore
8. Eastern Shore

The Fall Line, which separates the coastal plain from the Piedmont, is an important limiting factor in local distribution. Likewise, many of the other physiographic boundaries of the eight divisions produce distributional barriers to amphibians and reptiles.

On the distribution maps, in some cases, expected ranges will be represented in the form of shaded areas. The physiographic boundaries are used in several instances to separate different subspecies. The author realizes that this is not entirely accurate, but until a comprehensive study of each subspecies can be made, this will suffice to illustrate the general trend in distribution. County records unsubstantiated by specimens in a recognized collection and doubtful literature records have not been included in the charts of county and physiographic distribution. These records are indicated with circles (○) on the distribution maps. Specimens examined, and unquestionable literature records are represented on these maps by solid circles (●). For the purpose of this report, Baltimore City is considered to be part of Baltimore County.

A survey of this kind cannot be made without the willing help of many people. I am extremely grateful and indebted to Mr. John E. Cooper (Univ. Kentucky, Lexington, Kentucky), whose past form of the survey provided the preliminary ground work for this report, and to Mr. Richard Franz (Parkville Senior High School, Baltimore, Maryland) for valuable distribution data on *Pseudacris* and *Desmognathus*, and to Dr. Richard Highton (Univ. of Maryland, College Park, Maryland) for data on *Plethodon*. Mr. Pete Wemple supplied numerous data on Talbot County, Maryland. To the following people, I wish to extend my sincere thanks for valuable information concerning species distribution: Mr. James A. Fowler, Director of Education, Henry Ford Museum and Greenfield Village, Dearborn, Michigan; Dr. George J. Jacobs, Bethesda, Maryland; and to Mr. Richard D. Worthington, The University of Chicago, Chicago, Illinois.

To the following I must also extend my sincere thanks for data on Maryland amphibians and reptiles: Howard W. Campbell, Daniel Carver, John Crenshaw, Roger Conant, Frank Groves, Richard Hahn, Jerry D. Hardy, David S. Lee, Jack Norman, Arnold Norden, James A. Peters, Clyde E. Prince, John A. Rahnis, Neil D. Richmond, Jack Ruppert, Frank J. Schwartz, William Shirey, Robert S. Simmons, Charles J. Stine and Robert G. Tuck.

To Jo Ann Harris and Daniel J. Lyons I am grateful for assistance in the preparation of this manuscript.

The Amphibians and Reptiles of Maryland and the District of Columbia

Caudata

1 (1). *Cryptobranchus alleganiensis alleganiensis*. Hellbender.
2 (2). *Notophthalmus viridescens viridescens*. Red-spotted newt.
3 (3). *Ambystoma jeffersonianum*. Jefferson salamander.
4 (4). *Ambystoma maculatum*. Spotted salamander.
5 (5). *Ambystoma opacum*. Marbled salamander.
6 (6). *Ambystoma tigrinum tigrinum*. Eastern tiger salamander.
7 (7). *Aneides aeneus*. Green salamander.
8 (8). *Eurycea bislineata bislineata*. Northern two-lined salamander.
9 (9). *Eurycea longicauda longicauda*. Long-tailed salamander.
10 (10). *Hemidactylium scutatum*. Four-toed salamander.
11 (11). *Plethodon cinereus cinereus*. Red-backed salamander.
12 (12). *Plethodon richmondi richmondi*. Ravine salamander.
13 (13). *Plethodon glutinosus glutinosus*. Slimy salamander.
14 (14). *Gyrinophilus porphyriticus porphyriticus*. Northern spring salamander.
15 (15). *Pseudotriton montanus montanus*. Eastern mud salamander.
16 (16). *Pseudotriton ruber ruber*. Northern red salamander.
17 (17). *Desmognathus fuscus fuscus*. Northern dusky salamander.
18 (18). *Desmognathus ochrophaeus ochrophaeus*. Allegheny mountain salamander.
19 (19). *Desmognathus monticola monticola*. Appalachian seal salamander.
20 (20). *Siren lacertina*. Greater siren.

Salientia

21 (1). *Scaphiopus holbrooki holbrooki*. Eastern spadefoot toad.
22 (2). *Bufo americanus americanus*. American toad.
23 (3). *Bufo woodhousei fowleri*. Fowler's toad.
24 (4). *Acris crepitans crepitans*. Northern cricket frog.
25 (5) *Hyla cinerea*. Green treefrog. Upper Tidewater Potomac River populations, previously recognized as *Hyla cinerea evittata*.
26 (6). *Hyla crucifer crucifer*. Northern spring peeper.
27 (7). *Hyla versicolor versicolor*. Eastern gray treefrog.
28 (8). *Pseudacris triseriata feriarum*. Upland chorus frog.
29 (9). *Pseudacris triseriata kalmi*. New Jersey chorus frog.
30 (10). *Pseudacris brachyphona*. Mountain chorus frog.
31 (11). *Gastrophryne carolinensis carolinensis*. Eastern narrow-mouthed toad.
32 (12). *Rana catesbeiana*. Bullfrog.
33 (13). *Rana virgatipes*. Carpenter frog.
34 (14). *Rana clamitans melanota*. Green frog.
35 (15). *Rana pipiens pipiens*. Northern leopard frog.
36 (16). *Rana pipiens sphenocephala*. Southern leopard frog.

37 (17). *Rana palustris palustris*. Pickerel frog.
38 (18). *Rana sylvantica sylvantica*. Wood frog.

Squamata (Sauria)

39 (1). *Sceloporus undulatus hyacinthinus*. Northern fence lizard.
40 (2). *Cnemidophorus sexlineatus*. Six-lined racerunner.
41 (3). *Lygosoma laterale*. Ground skink.
42 (4). *Eumeces anthracinus anthracinus*. Northern coal skink.
43 (5). *Eumeces fasciatus*. Five-lined skink.
44 (6). *Eumeces laticeps*. Broad-headed skink.

Squamata (Serpentes)

45 (1). *Carphophis amoenus amoenus*. Eastern worm snake.
46 (2). *Farancia erytrogramma erytrogramma*. Rainbow snake.
47 (3). *Diadophis punctatus punctatus/edwardsi*. Intergrade population between southern and northern ringneck snakes on the coastal plain Delmarva.
48 (4). *Diadophis punctatus edwardsi*. Northern ringneck snake.
49 (5). *Heterodon platyrhinos*. Eastern hognose snake.
50 (6). *Opheodrys aestivus*. Rough green snake.
51 (7). *Opheodrys vernalis vernalis*. Eastern smooth green snake.
52 (8). *Coluber constrictor constrictor*. Northern black racer.
53 (9). *Elaphe obsoleta obsoleta*. Black rat snake.
54 (10). *Elaphe guttata guttata*. Corn snake.
55 (11). *Lampropeltis getulus getulus*. Eastern kingsnake.
56 (12). *Lampropeltis calligaster rhombomaculata*. Mole snake.
57 (13). *Lampropeltis doliata triangulum*. Eastern milk snake.
58 (14). *Lampropeltis doliata temporalis*. Coastal plain milk snake.
59 (15). *Cemophora coccinea coccinea*. Scarlet snake.
60 (16). *Natrix erythrogaster erythrogaster*. Red-bellied water snake.
61 (17). *Natrix sipedon sipedon*. Northern water snake.
62 (18). *Regina septemvittata septemvittata*. Queen snake.
63 (19). *Storeria dekayi dekayi*. Northern brown snake.
64 (20). *Storeria occipitomaculata occipitomaculata*. Northern red-bellied snake.
65 (21). *Virginia valeriae valeriae*. Eastern earth snake.
66 (22). *Virginia valeriae pulchra*. Mountain earth snake.
67 (23). *Thamnophis sauritus sauritus*. Eastern ribbon snake.
68 (24). *Thamnophis sirtalis sirtalis*. Eastern garter snake.
69 (25). *Agkistrodon contortrix mokeson*. Northern copperhead. Southern Eastern Shore populations exhibit *A. c. contortrix* influences. Specimens from southern St. Mary's County also show some *contortrix* tendencies.
70 (26). *Crotalus horridus horridus*. Timber rattlesnake.

Chelonia

71 (1). *Sternothaerus odoratus*. Stinkpot.
72 (2). *Kinosternon subrubrum subrubrum*. Eastern mud turtle.
73 (3). *Chelydra serpentina serpentina*. Snapping turtle.
74 (4). *Clemmys guttata*. Spotted turtle.
75 (5). *Clemmys insculpta*. Wood turtle.

76 (6). *Clemmys muhlenbergi*. Bog turtle.
77 (7). *Terrapene carolina carolina*. Eastern box turtle.
78 (8). *Malaclemys terrapin terrapin*. Northern diamondback terrapin.
79 (9). *Graptemys geographica*. Map turtle.
80 (10). *Chrysemys picta picta*. Eastern painted turtle. Appears to be intergrated to some extent with *C. p. marginata* in western Maryland.
81 (11). *Chrysemys rubriventris*. Red-bellied turtle.
82 (12). *Chrysemys scripta elegans*. Red-eared turtle. Feral.
83 (13). *Chrysemys scripta troosti*. Cumberland turtle. Feral.
84 (14). *Chelonia mydas mydas*. Atlantic green turtle.
85 (15). *Eretmochelys imbricata imbricata*. Atlantic hawksbill.
86 (16). *Caretta caretta caretta*. Atlantic loggerhead.
87 (17). *Lepidochelys kempi*. Atlantic ridley.
88 (18). *Dermochelys coriacea coricea*. Atlantic leatherback.

Doubtful or Erroneous Records and Possible Additions with a Comment on *Siren lacertina*

I. In the past, the following species have appeared on checklists of Maryland herpetofauna. Some of these records are due to old and unsubstantiated accounts and misidentification; other occurrences are presently doubtful. I am, at this time, removing them until they can be proved part of the Maryland fauna:

Hyla femoralis - Reported from Calvert County, Maryland, by Fowler and Orton (1947) on the basis of four specimens collected at Battle Creek cypress swamp. Much doubt does exist (Fowler, 1969) as to whether or not this record is valid. Diligent searching has failed to produce additional specimens. Until the existence of *H. femoralis* in Maryland can be verified, it cannot be included in the state list. The nearest known locality is near Lanexa, New Kent County, Virginia.

Pituophis melanoleucus melanoleucus - The existing state records are doubtful and no specimens are available. The sporatic range of this snake apparently does not include Maryland.

Chrysemys floridana floridana - Upon re-examination, all available Maryland material previously assigned to this species has been found to be *C. rubriventris*. Nearest reliable *floridana* records are from the Rappahannock River, 5 mi. SE of Fredericksburg, Virginia, and the Dismal Swamp, Virginia.

Chrysemys concinna concinna - Originally placed on the state list by Harris (Cooper, 1965) on the basis of two hatchlings collected in the Patapsco River at its intersection with the Baltimore-Washington Parkway. Since numerous attempts to locate additional specimens have been fruitless, it would be best to remove *concinna* until it can be proven to be native or established in Maryland. Nearest reliable records are from the Dismal Swamp area, Virginia.

II. Possible Additions

Plethodon wehrlei wehrlei - Reliable records in Pennsylvania and West Virginia indicate that this salamander possibly exists in extreme western Garrett County.

Trionyx spinifer spinifer - Records for this turtle in Pennsylvania and West Virginia indicate that this turtle may be found in the rivers in western Garrett County (Ohio drainage). Attempts have been made in the past to establish this species in the Potomac River.

Necturus maculosus maculosus - Since this salamander occurs in the Ohio tributaries of western Pennsylvania, it could occur in this drainage system in western Garrett County.

Eurycea longicauda guttolineata - Possibly occuring from the District of Columbia south into Prince George's County and into southern Maryland on the western shore, although the Potomac River is probably a barrier to this salamander. *E. l. guttolineata* has been collected within 500 feet of the Potomac River in a tributary of Difficult Creek, Virginia.

Desmognathus monticola jeffersoni - This salamander occurs in the Blue Ridge of Virginia, but the Potomac River (Harper's Ferry) produces a probable barrier to the northeast extension of its range into Maryland.

III. Comments

Siren lacertina - An old record for the Potomac Flats (Hay, 1902) is apparently valid. At this time it is uncertain that this salamander still exists in Maryland. It should be searched for in southern Maryland, especially along the Potomac River. *S. lacertina* has been observed and collected at Camp A. P. Hill, Caroline County, Virginia.

AMPHIBIA	Allegany	Anne Arundel	Baltimore	Caroline	Carroll	Calvert	Cecil	Charles	Dist. of Columbia	Dorchester	Frederick	Garrett	Harford	Howard	Kent	Montgomery	Prince George's	Queen Anne's	Somerset	St. Mary's	Talbot	Washington	Wicomico	Worcester
C. a. alleganiensis							●					●	●											
N. v. viridescens	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			●	●	●		
A. jeffersonianum	●										●											●		
A. maculatum	●	●	●		●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●		
A. opacum	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
A. t. tigrinum		●		●				●		●					●			●						●
A. aeneus												●												
E. b. bislineata	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●	●	
E. l. longicauda	●		●		●		●				●	●	●	●		●						●		
H. scutatum	●	●	●	●		●	●	●	●	●		●	●	●	●	●	●			●		●	●	●
P. c. cinereus	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
P. r. richmondi	●											●										●		
P. g. glutinosus	●		●		●		●				●	●	●	●		●						●		
G. p. porphyriticus	●										●	●										●		
P. m. montanus		●	●			●		●	●							●	●	●		●			●	●
P. r. ruber	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●		
D. f. fuscus	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●		●	●	●	●	
D. o. ochrophaeus	●											●												
D. m. monticloa	●											●												
S. lacertina									●															
S. h. holbrooki		●		●		●		●	●	●	●				●		●		●	●	●		●	●
B. a. americanus	●	●	●		●	●	●	●	●		●	●	●	●		●	●					●	●	●
B. w. fowleri	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
A. c. crepitans	●	●	●	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●
H. cinerea		●	●			●	●	●	●	●			●		●	●	●	●	●	●	●		●	●
H. c. crucifer	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
H. v. versicolor	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●		●	●
P. t. feriarum	●	●	●		●	●		●	●		●		●	●		●	●			●		●		
P. t. kalmi				●			●			●					●			●	●		●		●	●
P. brachyphona	●											●												
G. c. carolinensis						●				●										●				
R. catesbeiana	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R. virgatipes										●													●	●
R. c. melanota	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R. p. pipiens	●		●		●		●				●	●	●	●		●						●		
R. p. sphenocephala		●		●		●		●	●	●					●		●	●	●	●	●		●	●
R. p. palustris	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●
R. s. sylvatica	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●		●	●	●	●

REPTILIA	Allegany	Anne Arundel	Baltimore	Caroline	Carroll	Calvert	Cecil	Charles	Dist. of Columbia	Dorchester	Frederick	Garrett	Harford	Howard	Kent	Montgomery	Prince George's	Queen Anne's	Somerset	St. Mary's	Talbot	Washington	Wicomico	Worcester
S. u. hyacinthinus	•	•	•	•	•	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•
C. sexlineatus		•	•			•		•	•								•			•				
L. laterale		•				•		•	•	•							•		•	•			•	•
E. a. anthracinus	•											•												
E. fasciatus	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
E. laticeps		•	•			•	•	•		•	•					•	•	•	•	•	•	•	•	•
C. a. amoenus	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•
F. e. erytrogramma								•																
D. p. punctatus/edwardsi				•			•			•					•			•	•		•			•
D. p. edwardsi	•	•	•		•	•	•	•	•		•	•	•	•		•	•			•		•		
H. platyrhinos	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
O. aestivus		•	•	•		•	•	•	•	•			•	•		•	•	•	•	•	•	•	•	•
O. v. vernalis	•										•	•										•		
C. c. constrictor	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
E. o. obsoleta	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
E. g. guttata		•		•		•		•	•							•	•			•	•		•	
L. g. getulus		•	•	•		•	•	•	•	•			•	•	•	•	•	•	•	•	•		•	•
L. c. rhombomaculata		•						•	•					•		•	•			•				
L. d. triangulum	•	•	•		•		•		•		•	•	•	•		•	•					•		
L. d. temporalis		•				•		•	•								•			•				•
C. coccinea		•	•			•			•								•						•	
N. e. erythrogaster																							•	
N. s. sipedon	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
R. s. septemvittata	•	•	•		•		•		•		•	•	•	•	•	•	•					•		
S. d. dekayi	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•
S. o. occipitomaculata	•	•	•			•	•	•	•		•	•		•				•		•		•	•	•
V. v. valeriae		•	•		•	•	•	•	•		•		•	•	•	•	•			•		•	•	•
V. v. pulchra												•												
T. s. sauritus	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
T. s. sirtalis	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•		•
A. c. mokeson	•	•	•		•	•	•	•	•		•	•	•	•		•	•		•	•		•	•	•
C. h. horridus	•		•								•	•										•		
S. odoratus	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•
K. s. subrubrum		•	•	•		•	•	•	•	•			•	•	•	•	•	•	•	•	•		•	•
C. s. serpentina	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
C. guttata	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•
C. insculpta	•		•				•				•	•	•			•	•					•		
C. muhlenbergi			•				•						•											
T. c. carolina	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
M. t. terrapin		•				•			•	•					•			•	•		•		•	•
G. geographica							•						•											
C. p. picta	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
C. rubriventris	•	•	•	•		•	•		•	•	•		•		•	•	•	•		•		•	•	•
C. m. mydas						•																		•
E. i. imbricata	Atlantic; no specific Maryland records																							
C. c. caretta						•				•														•
L. kempi			•			•																		
D. c. coriacea						•																		

FERAL

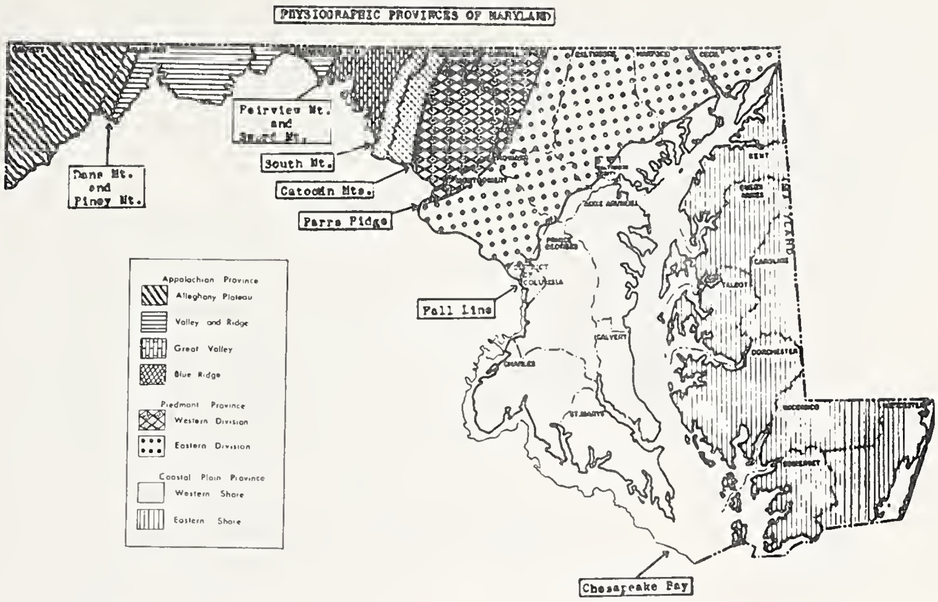
C. s. elegans		•	•														•					•		
C. s. troosti			•																					

REPTILIA	APPALACHIAN PROVINCE: Allegheny Plateau	APPALACHIAN PROVINCE: Valley and Ridge	APPALACHIAN PROVINCE: Great Valley	APPALACHIAN PROVINCE: Blue Ridge	PIEDMONT PROVINCE: Western Division	PIEDMONT PROVINCE: Eastern Division	COASTAL PLAIN PROVINCE: Western Shore (Inner Division)	COASTAL PLAIN PROVINCE: Eastern Shore (Outer Division)
S. u. hyacinthinus		●	●	●	●	●	●	●
C. sexlineatus							●	
L. laterale							●	●
E. a. anthracinus	●	?						
E. fasciatus	●	●	●	●	●	●	●	●
E. laticeps				●	●	●	●	●
C. a. amoenus		●	●	●	●	●	●	●
F. e. erytrogramma							●	
D. p. punctatus/edwardsi								●
D. p. edwardsi	●	●	●	●	●	●	●	
H. platyrhinos	●	●	●	●	●	●	●	●
O. aestivus			●			●	●	●
O. v. vernalis	●	●	●	●	●			
C. c. constrictor	●	●	●	●	●	●	●	●
E. o. obsoleta	●	●	●	●	●	●	●	●
E. g. guttata						●	●	●
L. g. getulus						●	●	●
L. c. rhombomaculata						●	●	
L. d. triangulum	●	●	●	●	●	●	●	?
L. d. temporalis							●	●
C. coccinea							●	●
N. e. erythrogaster								●
N. s. sipedon	●	●	●	●	●	●	●	●
R. s. septemvittata	●	●	●	●	●	●	●	●
S. d. dekayi	●	●			●	●	●	●
S. o. occipitomaculata	●	●			●	●	●	●
V. v. valeriae		●			●	●	●	●
V. v. pulchra	●							
T. s. sauritus	●	●	●	●	●	●	●	●
T. s. sirtalis	●	●	●	●	●	●	●	●
A. c. mokeson	●	●	●	●	●	●	●	●
C. h. horridus	●	●	●	●	●	●		
S. odoratus	●	●	●	●	●	●	●	●
K. s. subrubrum						●	●	●
C. s. serpentina	●	●	●	●	●	●	●	●
C. guttata	●	●	●	●	●	●	●	●
C. insculpta	●	●	●	●	●	●		
C. muhlenbergi						●		?
T. c. carolina	●	●	●	●	●	●	●	●
M. t. terrapin							●	●
G. geographica						●		●
C. p. picta	●	●	●	●	●	●	●	●
C. rubriventris		●		●	●	●	●	●
C. m. mydas							●	
E. i. imbricata							Atlantic	
C. c. caretta							●	●
L. kempi							●	
D. c. coriacea							●	

FERAL

C. s. elegans		●				●	●	
C. s. troosti						●		

AMPHIBIA	APPALACHIAN PROVINCE: Allegheny Plateau	APPALACHIAN PROVINCE: Valley and Ridge	APPALACHIAN PROVINCE: Great Valley	APPALACHIAN PROVINCE: Blue Ridge	PIEDMONT PROVINCE: Western Division	PIEDMONT PROVINCE: Eastern Division	COASTAL PLAIN PROVINCE: Western Shore (Inner Division)	COASTAL PLAIN PROVINCE: Eastern Shore (Outer Division)
C. a. alleganiensis	●					●		
N. v. viridenscens	●	●	●	●	●	●	●	●
A. jeffersonianum	●	●	?	●	?			
A. maculatum	●	●	●	●	●	●	●	●
A. opacum		●	●	●	●	●	●	●
A. t. tigrinum							●	●
A. aeneus	●							
E. b. bislineata	●	●	●	●	●	●	●	●
E. l. longicauda	●	●	●	●	●	●		
H. scutatum	●	●	●		●	●	●	●
P. c. cinereus	●	●	●	●	●	●	●	●
P. r. richmondi	●	●						
P. g. glutinosus	●	●	●	●	●	●		
G. p. porphyriticus	●	●	●	●	●			
P. m. montanus						●	●	●
P. r. ruber	●	●	●	●	●	●	●	●
D. f. fuscus	●	●	●	●	●	●	●	●
D. o. ochrophaeus	●	●						
D. m. monticloa	●	●						
S. lacertina							●	
S. h. holbrooki					●		●	●
B. a. americanus	●	●	●	●	●	●	●	●
B. w. fowleri	●	●	●	●	●	●	●	●
A. c. crepitans		●	●	●	●	●	●	●
H. cinerea						●	●	●
H. c. crucifer	●	●	●	●	●	●	●	●
H. v. versicolor	●	●			●	●	●	●
P. t. feriarum		●	●	●	●	●	●	
P. t. kalmi								●
P. brachyphona	●	●						
G. c. carolinensis							●	●
R. catesbeiana	●	●		●	●	●	●	●
R. virgatipes								●
R. c. melanota	●	●	●	●	●	●	●	●
R. p. pipiens	●	●	●	●	●	●		
R. p. sphenocephala							●	●
R. p. palustris	●	●	●	●	●	●	●	●
R. s. sylvatica	●	●	●	●	●	●	●	●



● Specimen examined, and/or unquestionable published record.

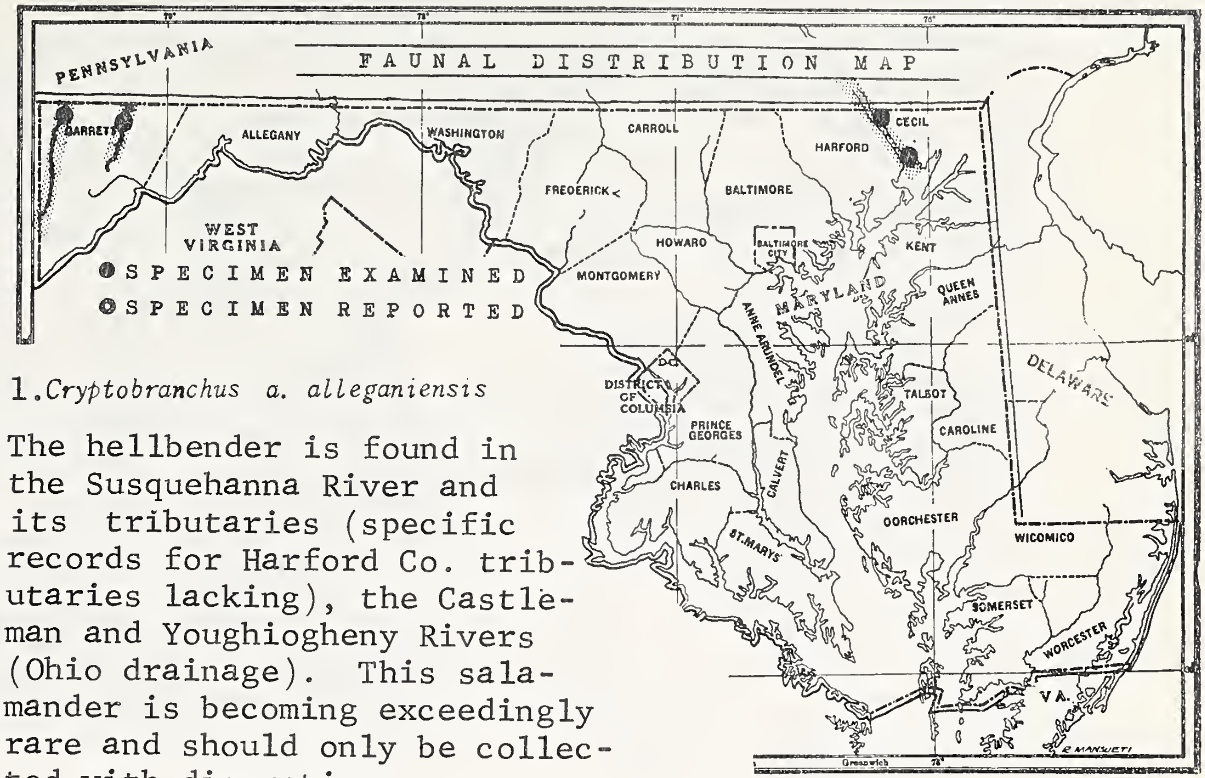
o Specimen reported, and/or questionable published record.

County record, exact locality unknown.

Expected distribution.

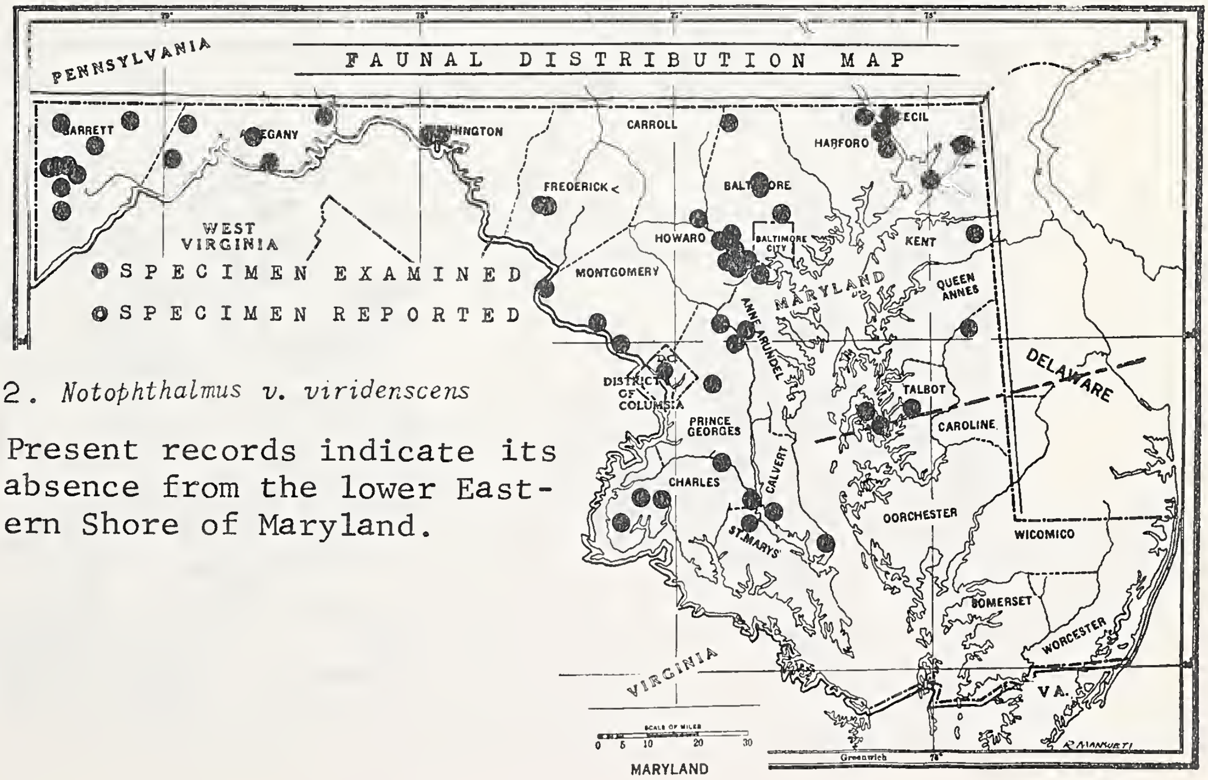
---- Extent of distribution.

Possible extent of distribution. The approximate northern limits of pure stands of the loblolly pine (Conant, 1945).



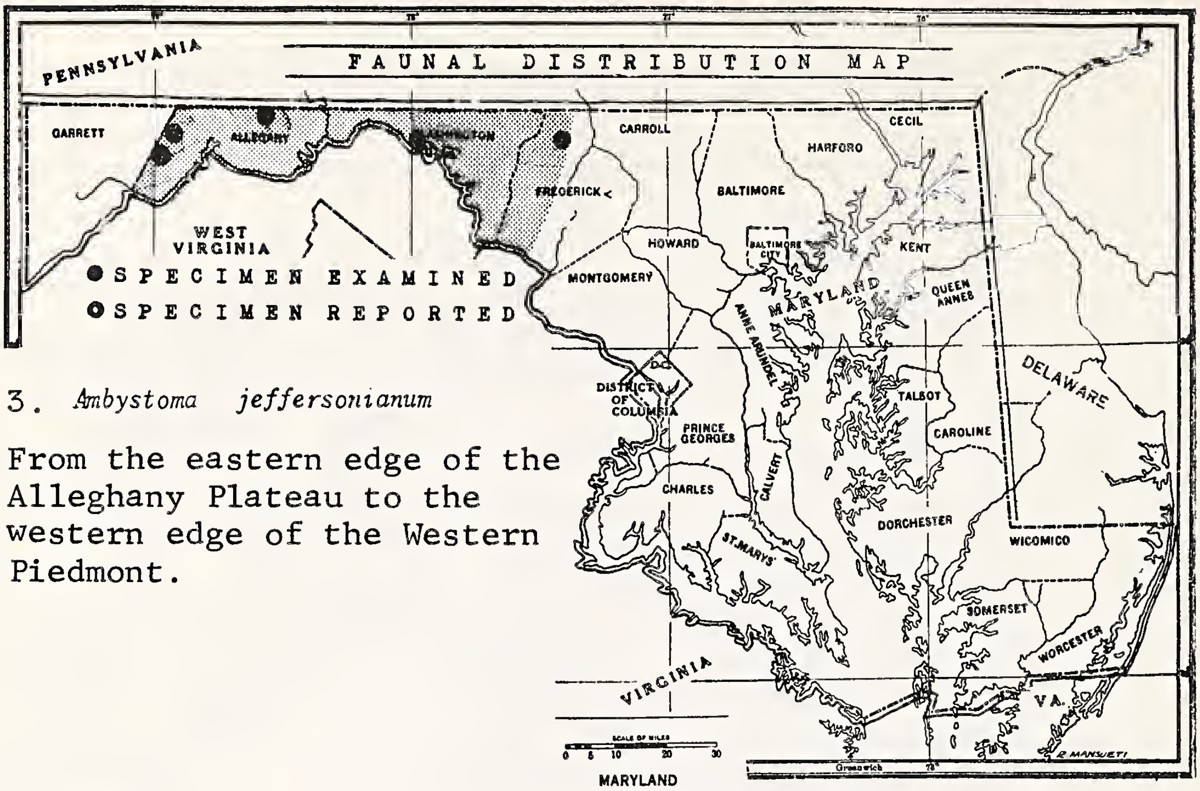
1. *Cryptobranchus a. alleganiensis*

The hellbender is found in the Susquehanna River and its tributaries (specific records for Harford Co. tributaries lacking), the Castleman and Youghiogheny Rivers (Ohio drainage). This salamander is becoming exceedingly rare and should only be collected with discretion.



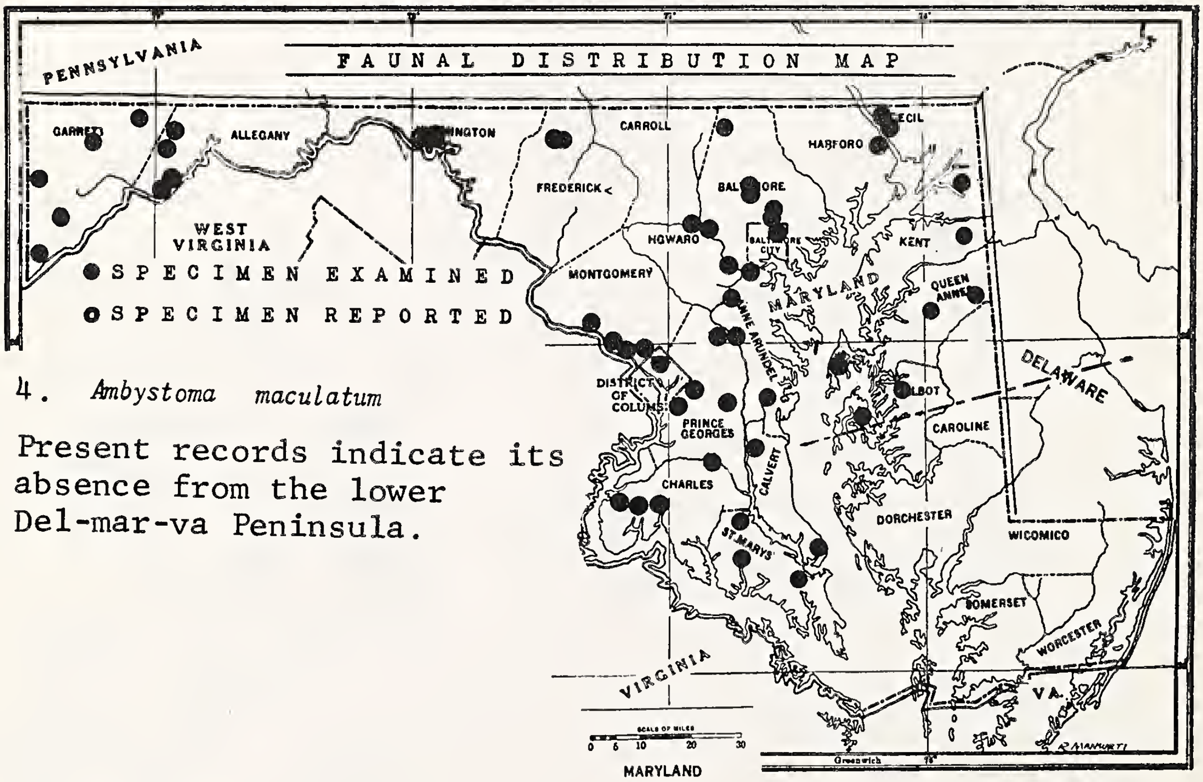
2. *Notophthalmus v. viridenscens*

Present records indicate its absence from the lower Eastern Shore of Maryland.



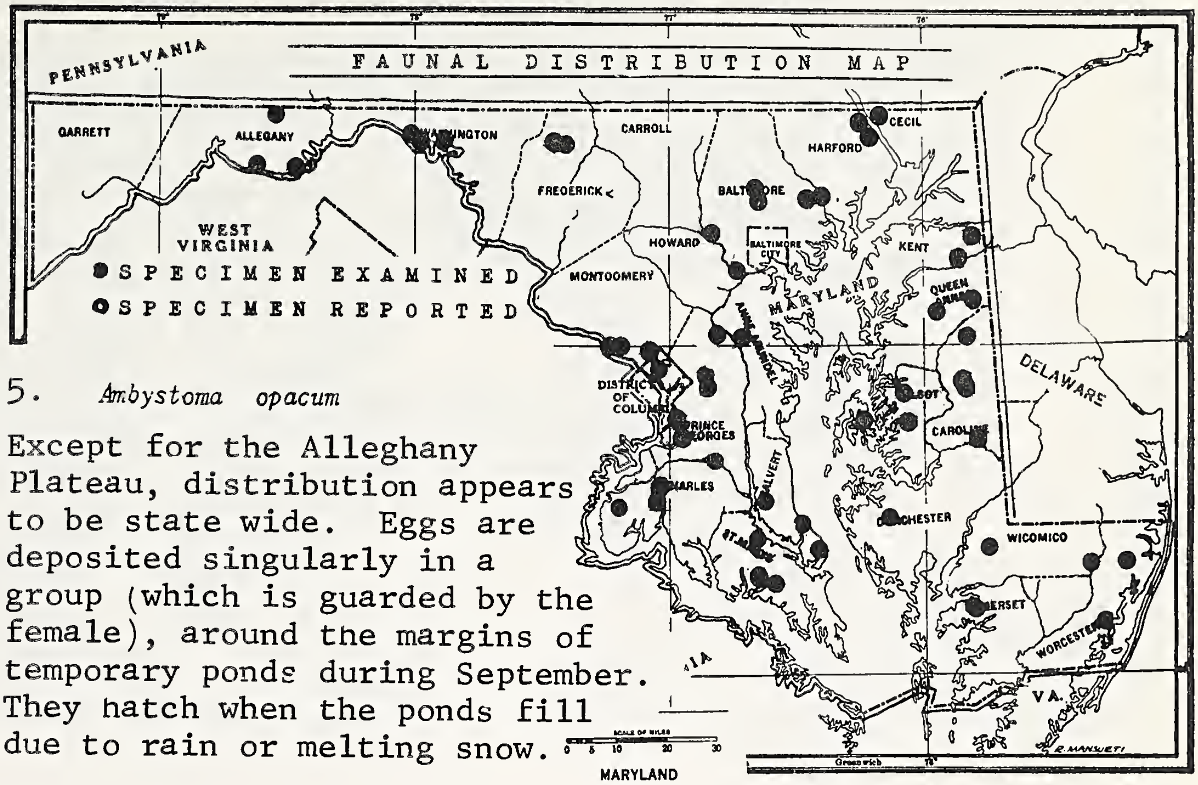
3. *Ambystoma jeffersonianum*

From the eastern edge of the Alleghany Plateau to the western edge of the Western Piedmont.



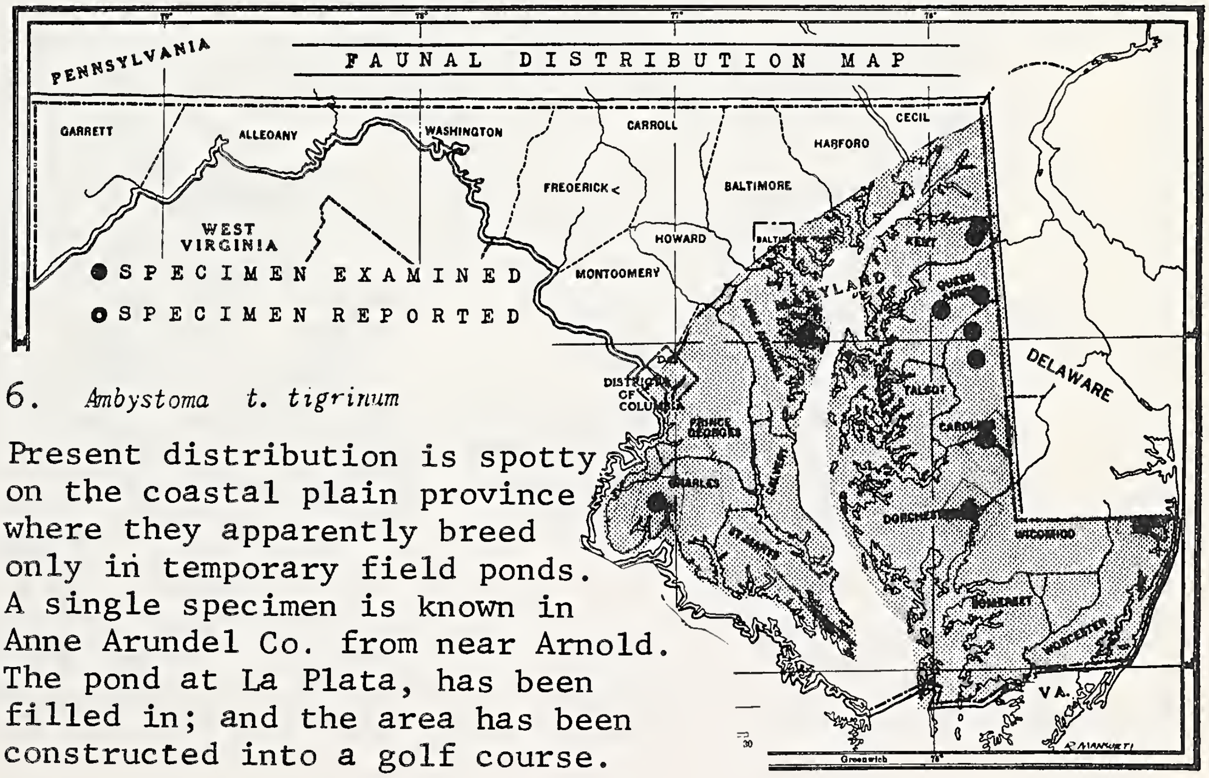
4. *Ambystoma maculatum*

Present records indicate its absence from the lower Del-mar-va Peninsula.



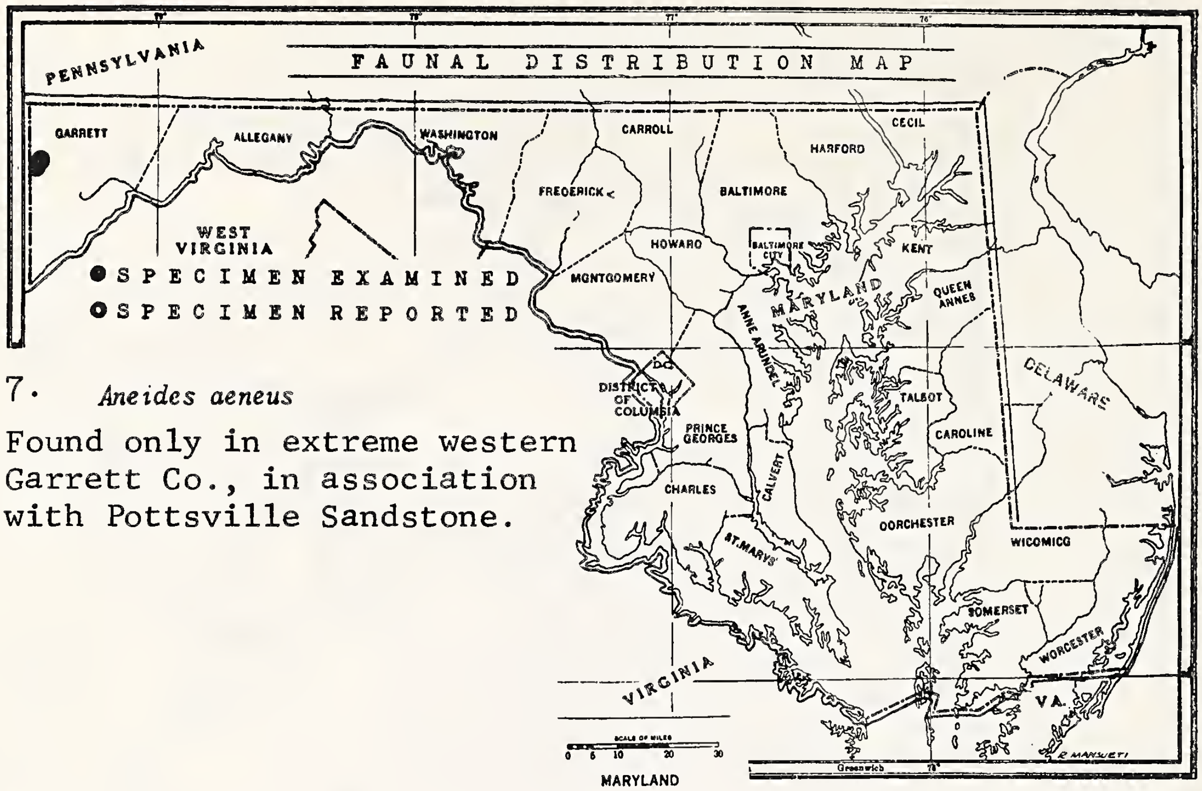
5. *Ambystoma opacum*

Except for the Alleghany Plateau, distribution appears to be state wide. Eggs are deposited singularly in a group (which is guarded by the female), around the margins of temporary ponds during September. They hatch when the ponds fill due to rain or melting snow.



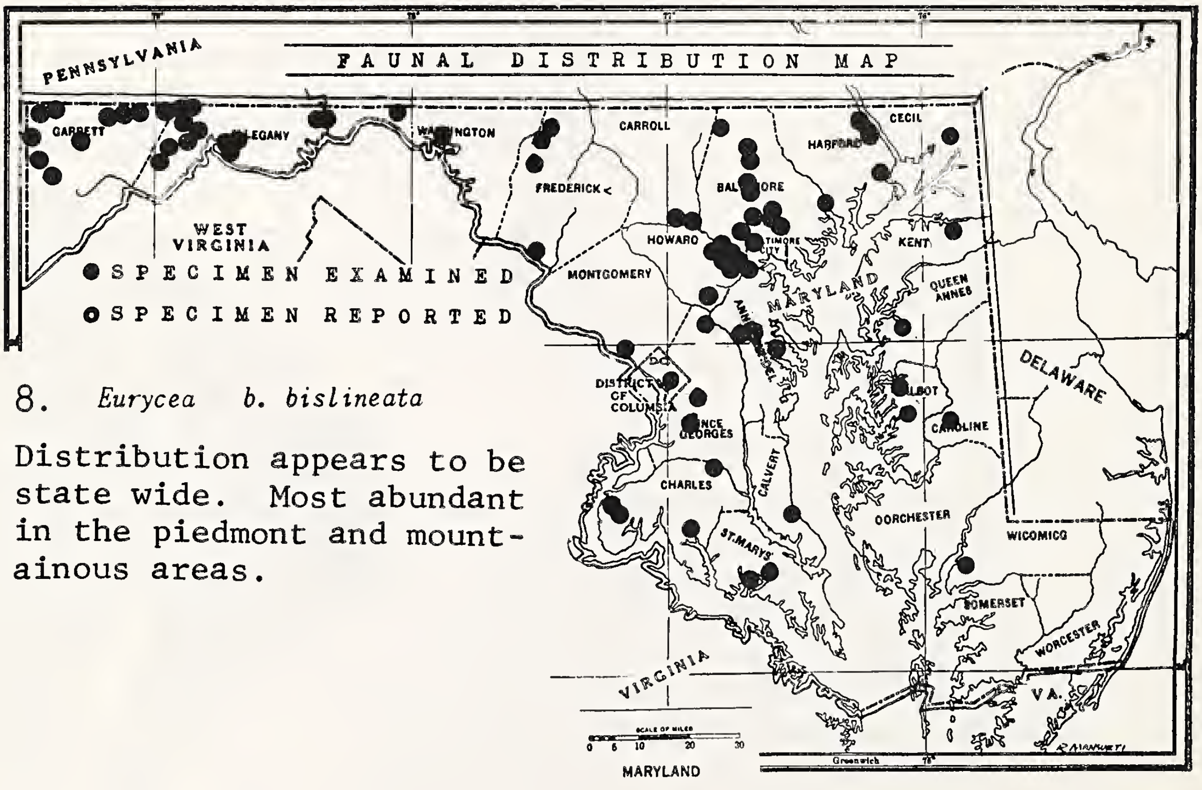
6. *Ambystoma t. tigrinum*

Present distribution is spotty on the coastal plain province where they apparently breed only in temporary field ponds. A single specimen is known in Anne Arundel Co. from near Arnold. The pond at La Plata, has been filled in; and the area has been constructed into a golf course.



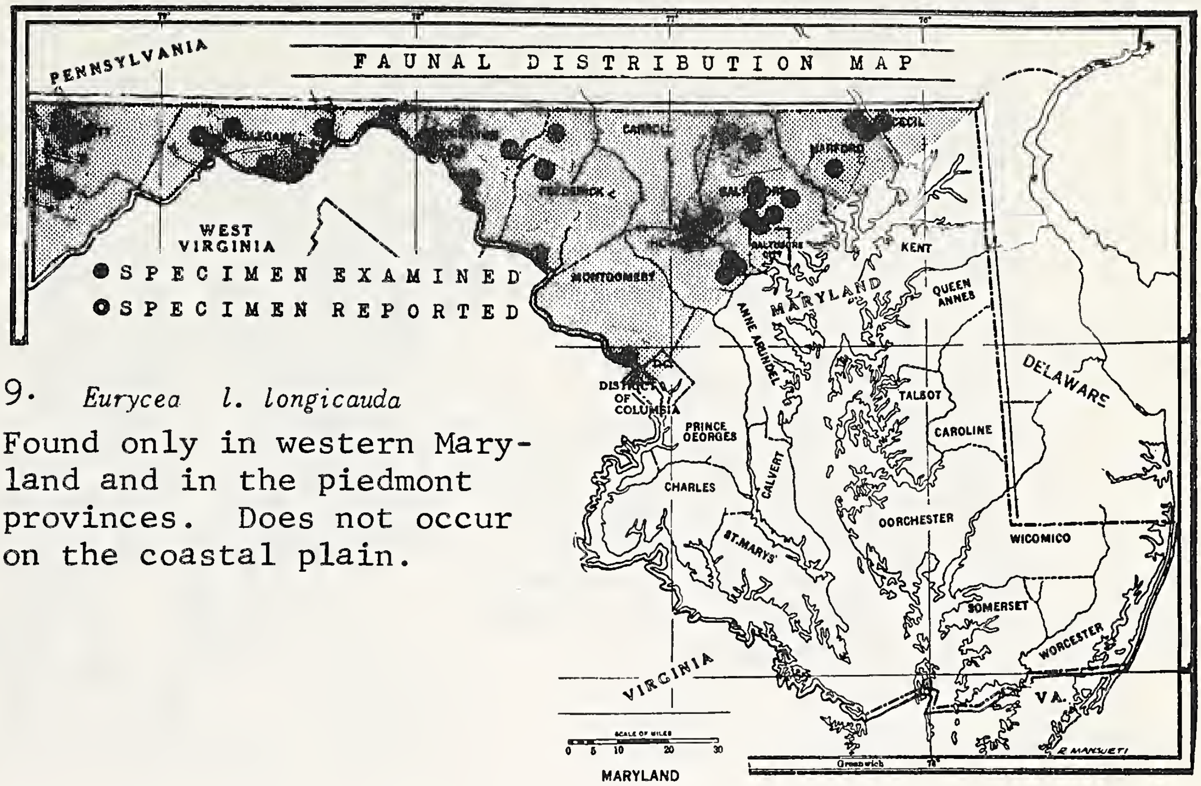
7. *Aneides aeneus*

Found only in extreme western Garrett Co., in association with Pottsville Sandstone.



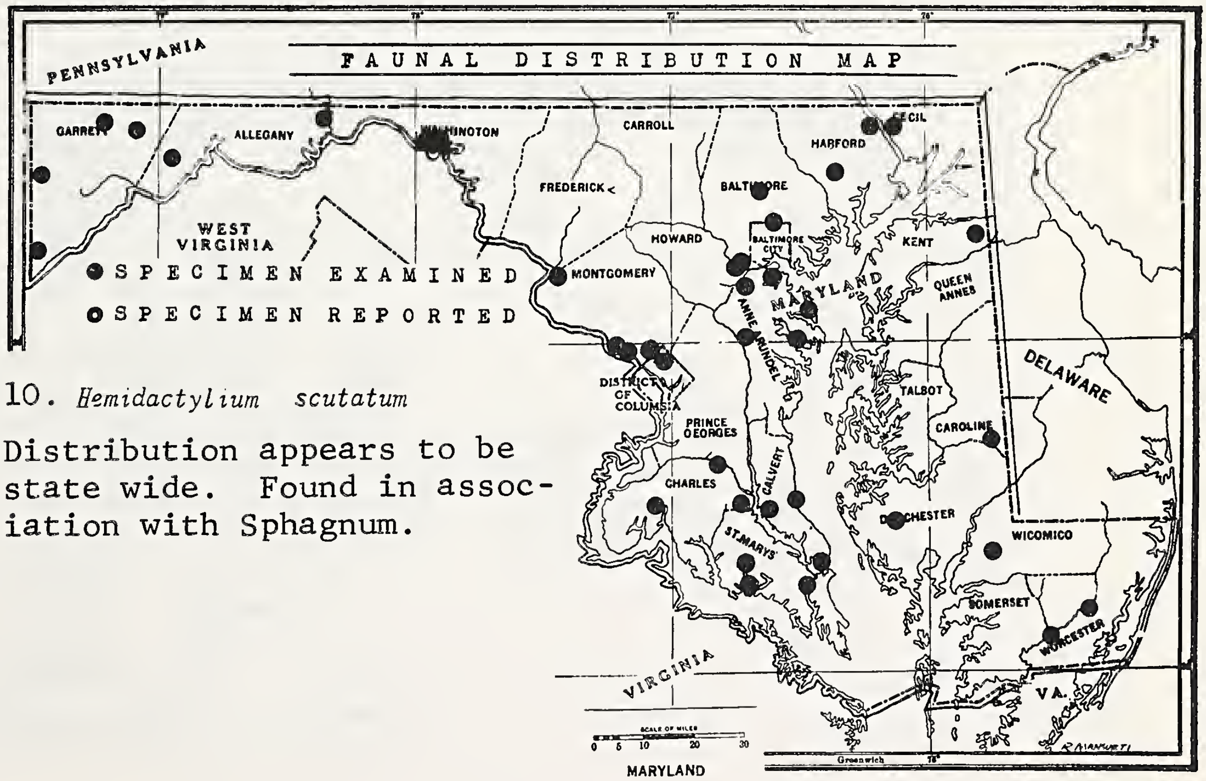
8. *Eurycea b. bislineata*

Distribution appears to be state wide. Most abundant in the piedmont and mountainous areas.



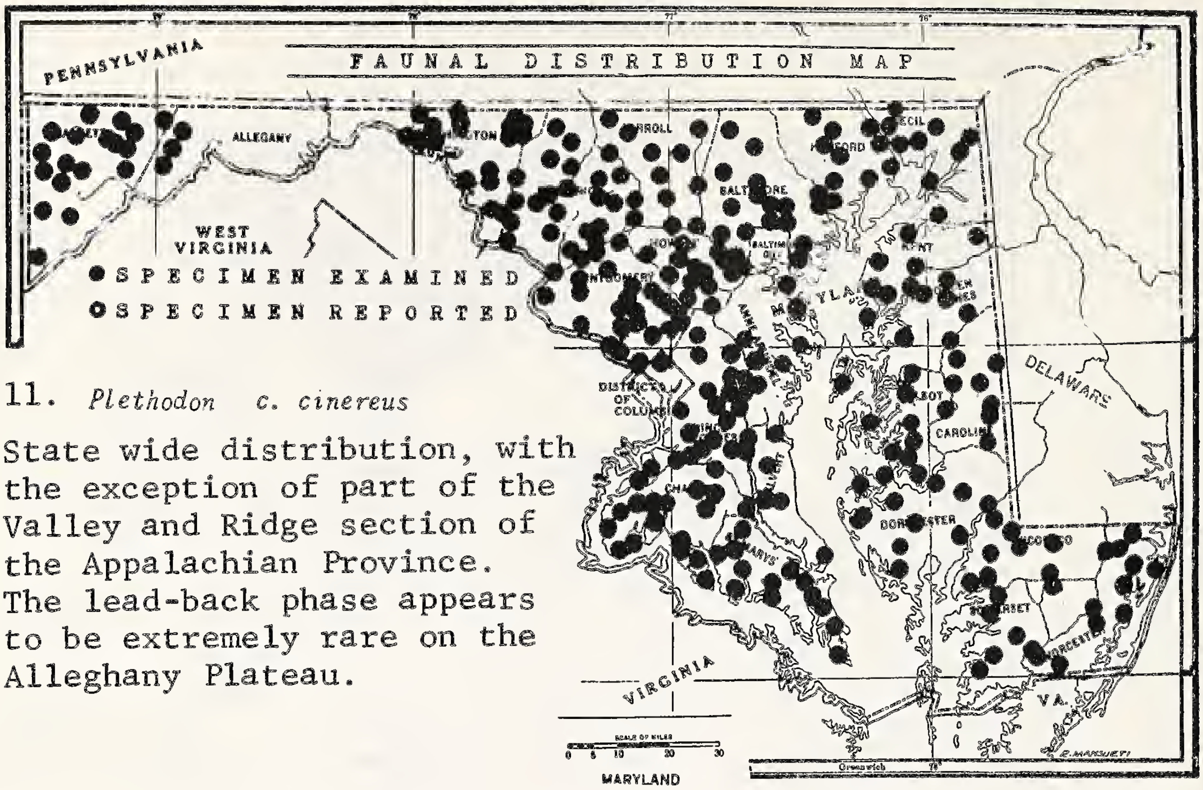
9. *Eurycea l. longicauda*

Found only in western Maryland and in the piedmont provinces. Does not occur on the coastal plain.



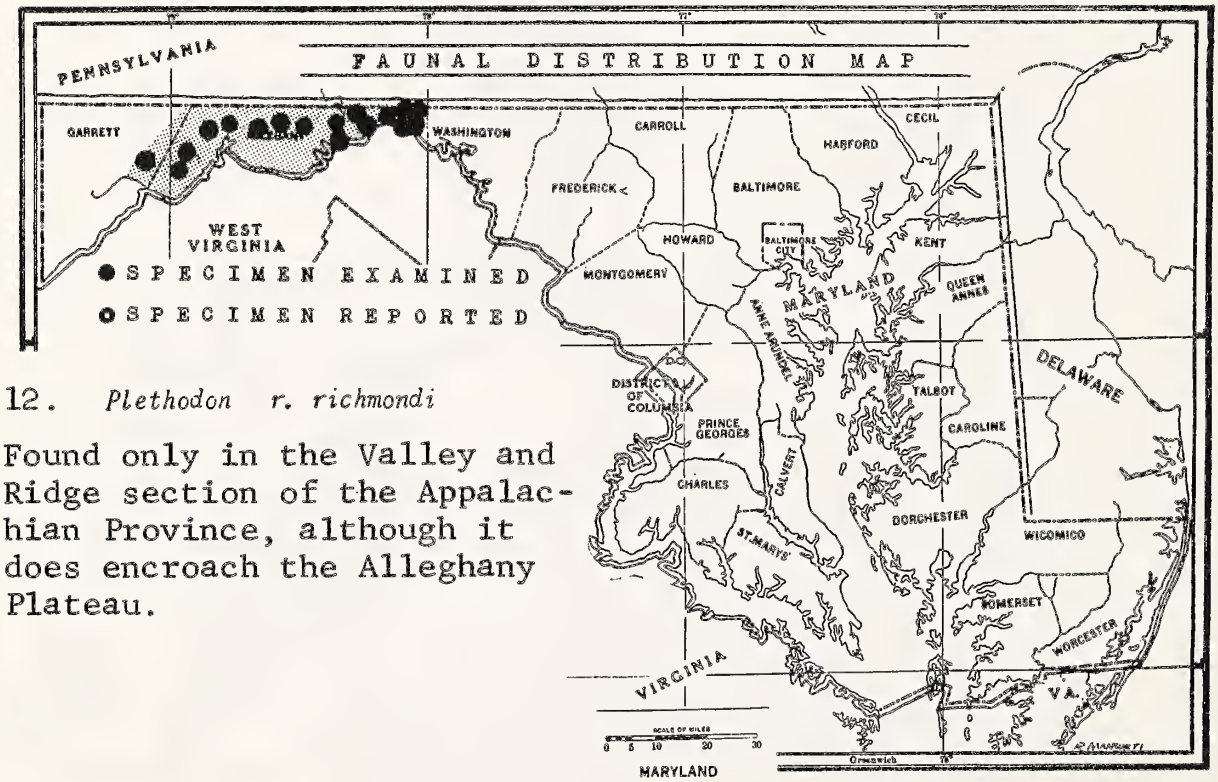
10. *Hemidactylium scutatum*

Distribution appears to be state wide. Found in association with Sphagnum.



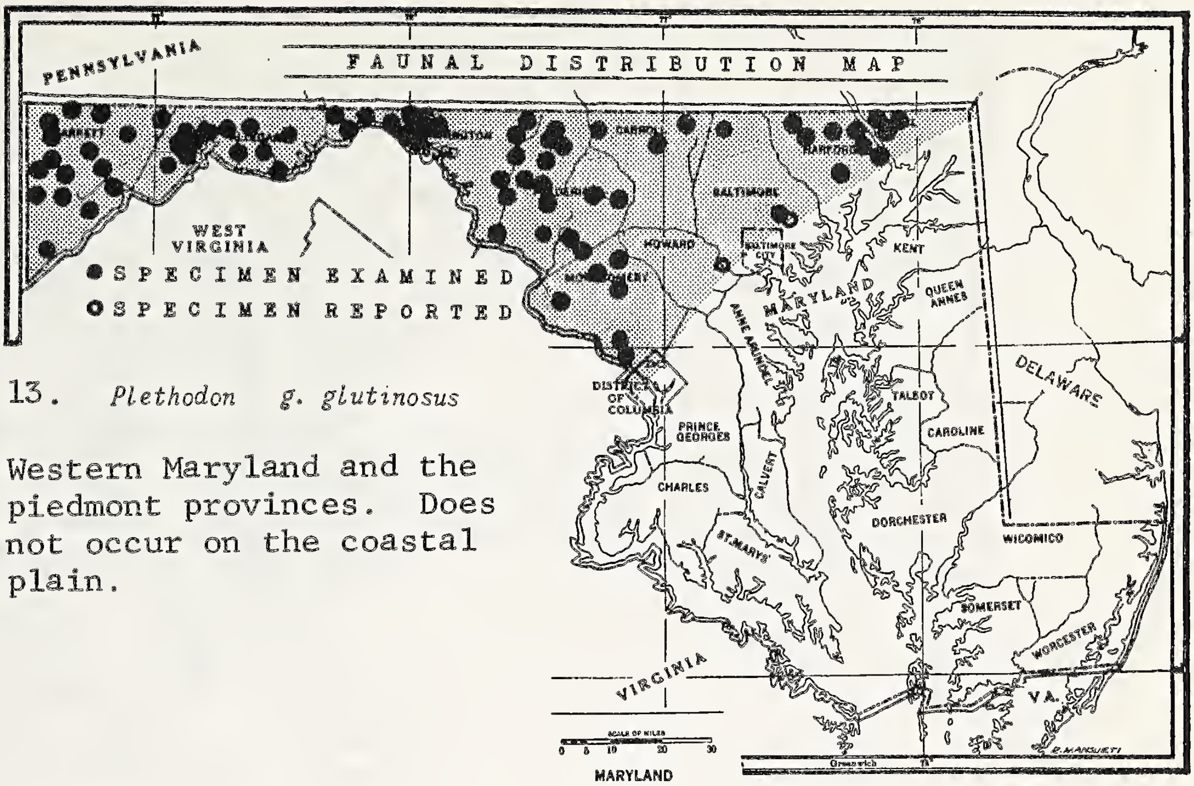
11. *Plethodon c. cinereus*

State wide distribution, with the exception of part of the Valley and Ridge section of the Appalachian Province. The lead-back phase appears to be extremely rare on the Alleghany Plateau.



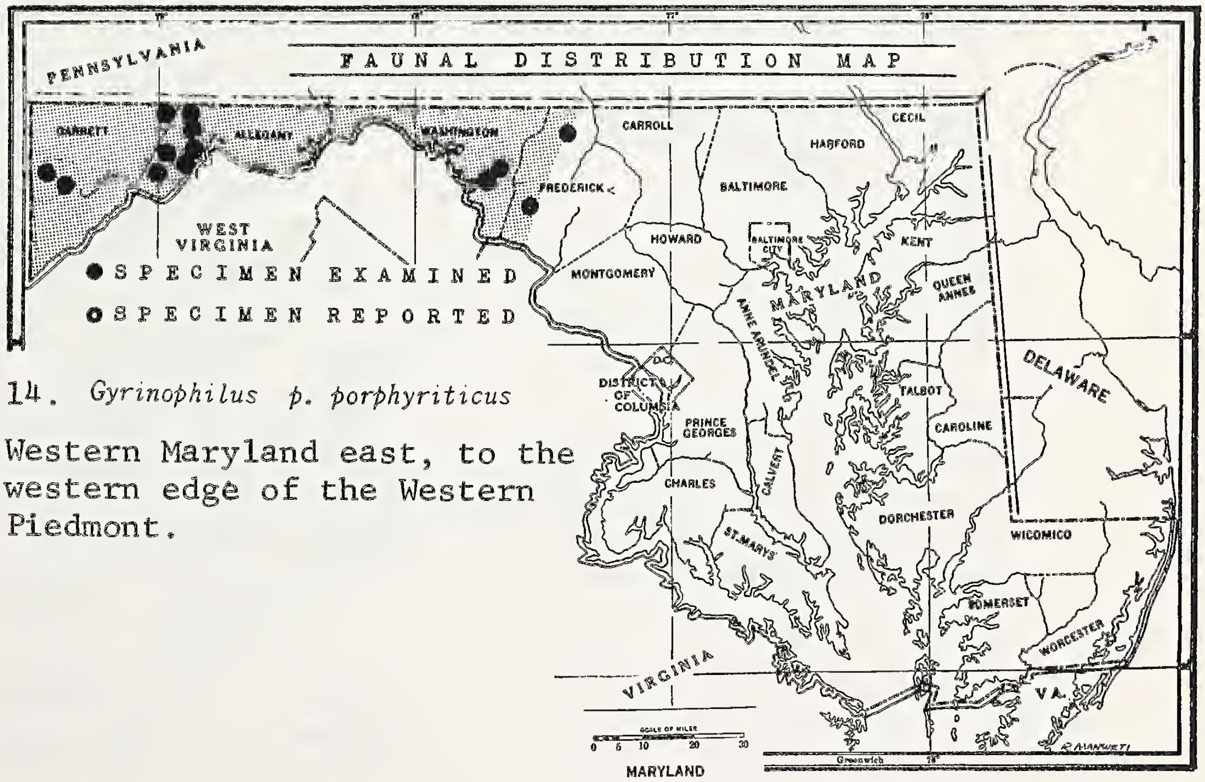
12. *Plethodon r. richmondi*

Found only in the Valley and Ridge section of the Appalachian Province, although it does encroach the Alleghany Plateau.



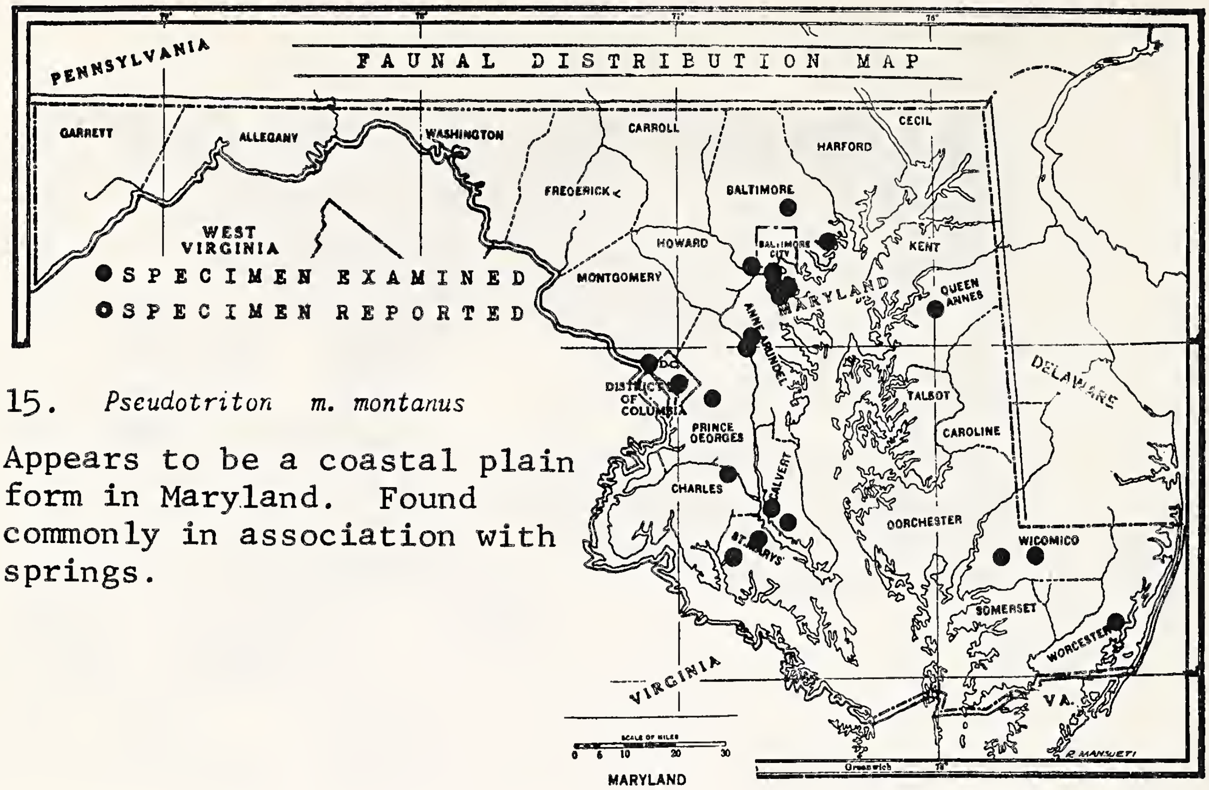
13. *Plethodon g. glutinosus*

Western Maryland and the piedmont provinces. Does not occur on the coastal plain.



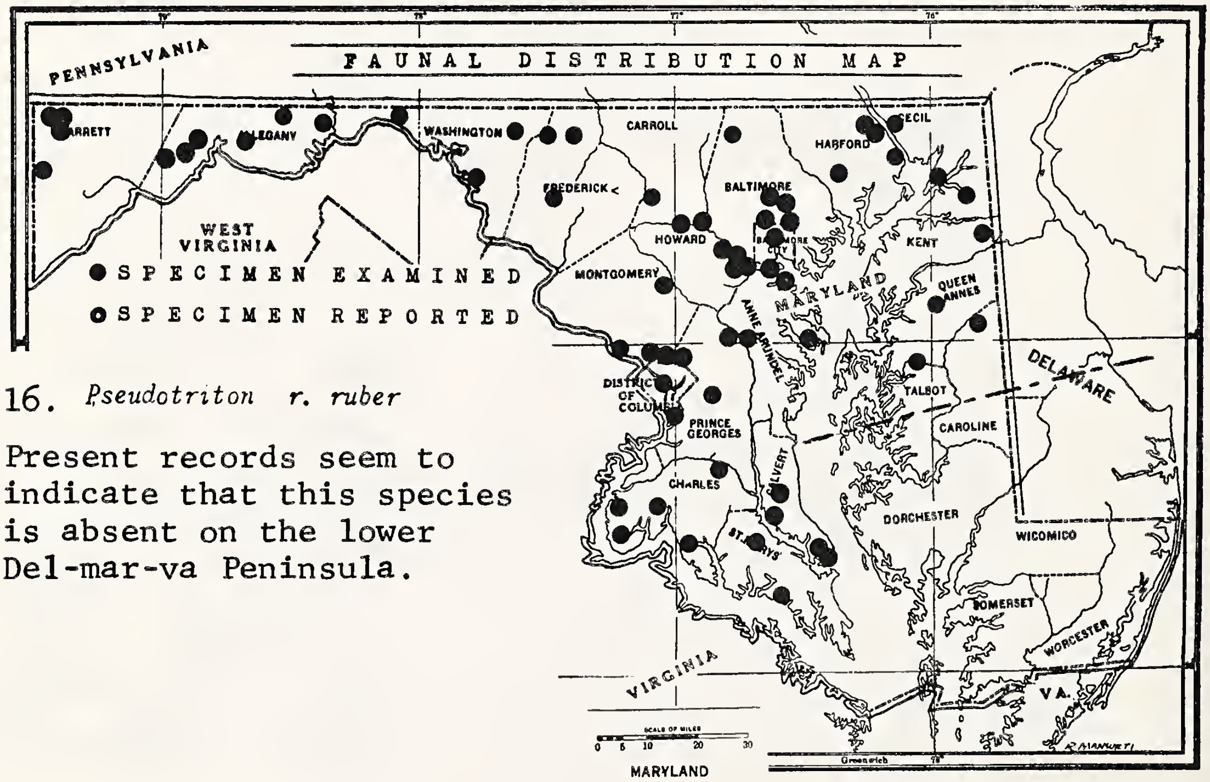
14. *Gyrinophilus p. porphyriticus*

Western Maryland east, to the western edge of the Western Piedmont.



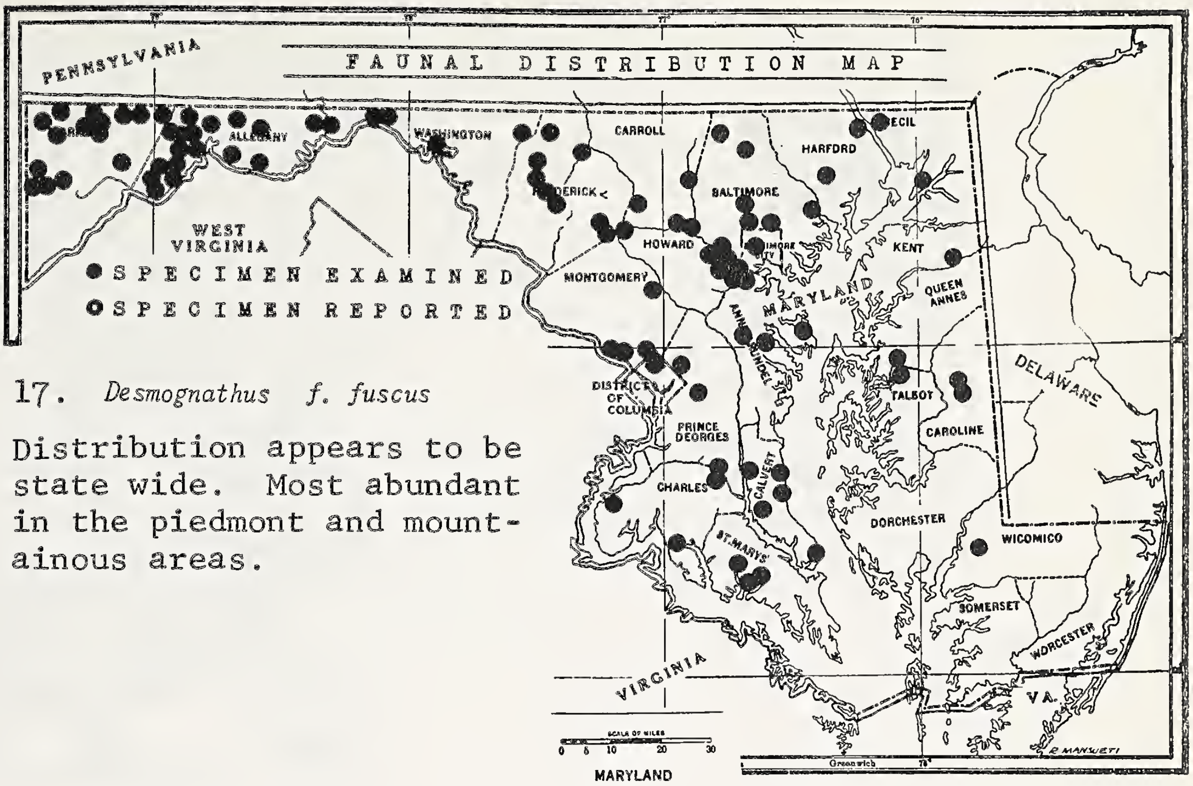
15. *Pseudotriton m. montanus*

Appears to be a coastal plain form in Maryland. Found commonly in association with springs.



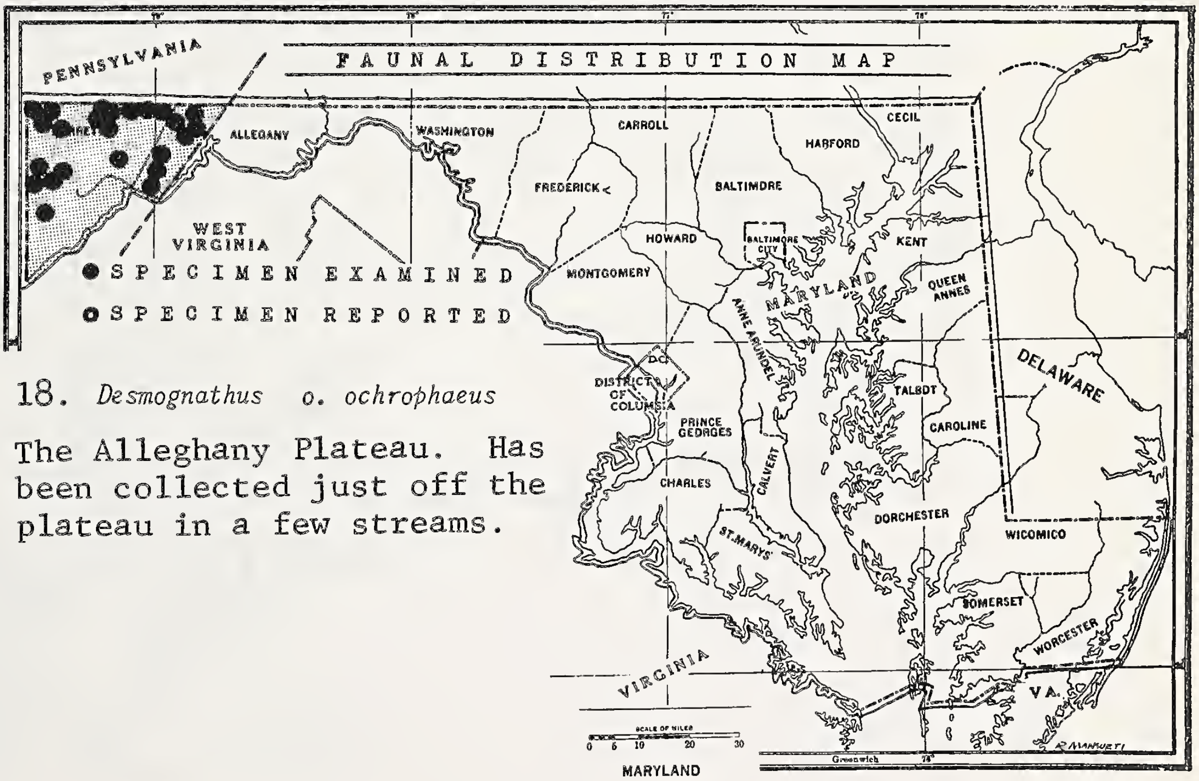
16. *Pseudotriton r. ruber*

Present records seem to indicate that this species is absent on the lower Del-mar-va Peninsula.



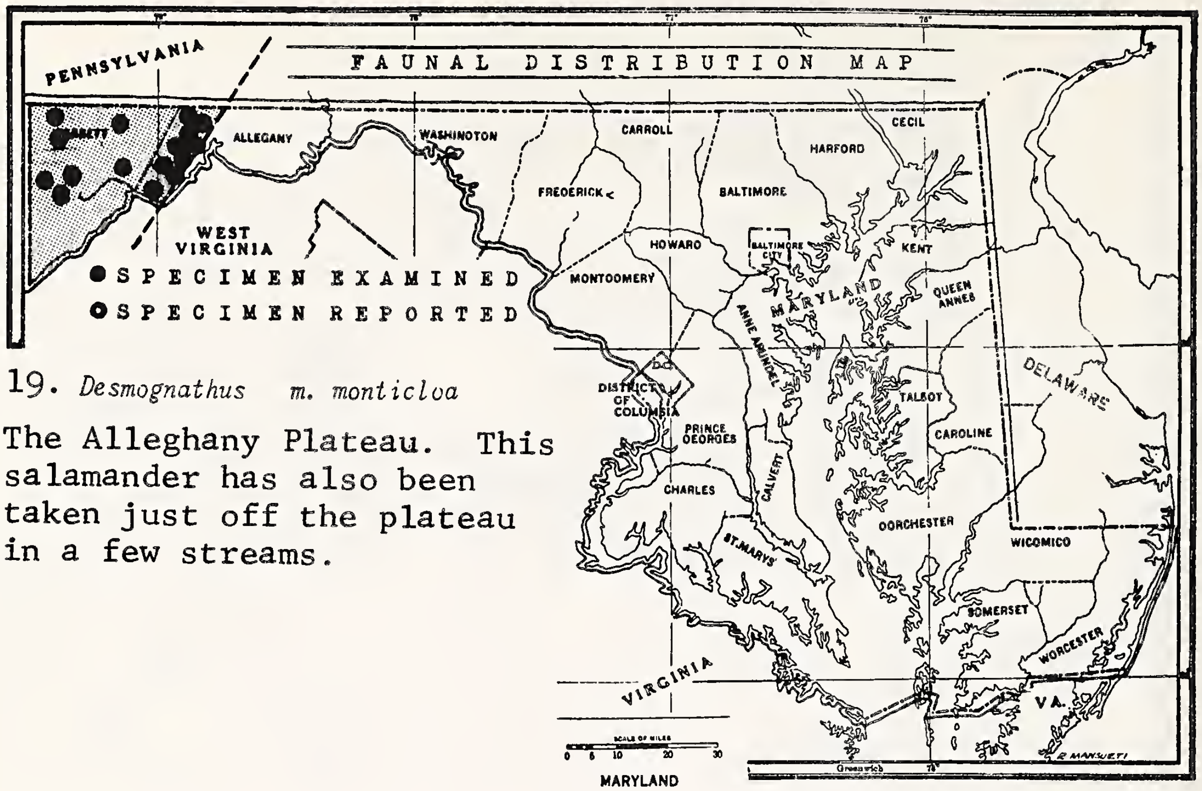
17. *Desmognathus f. fuscus*

Distribution appears to be state wide. Most abundant in the piedmont and mountainous areas.



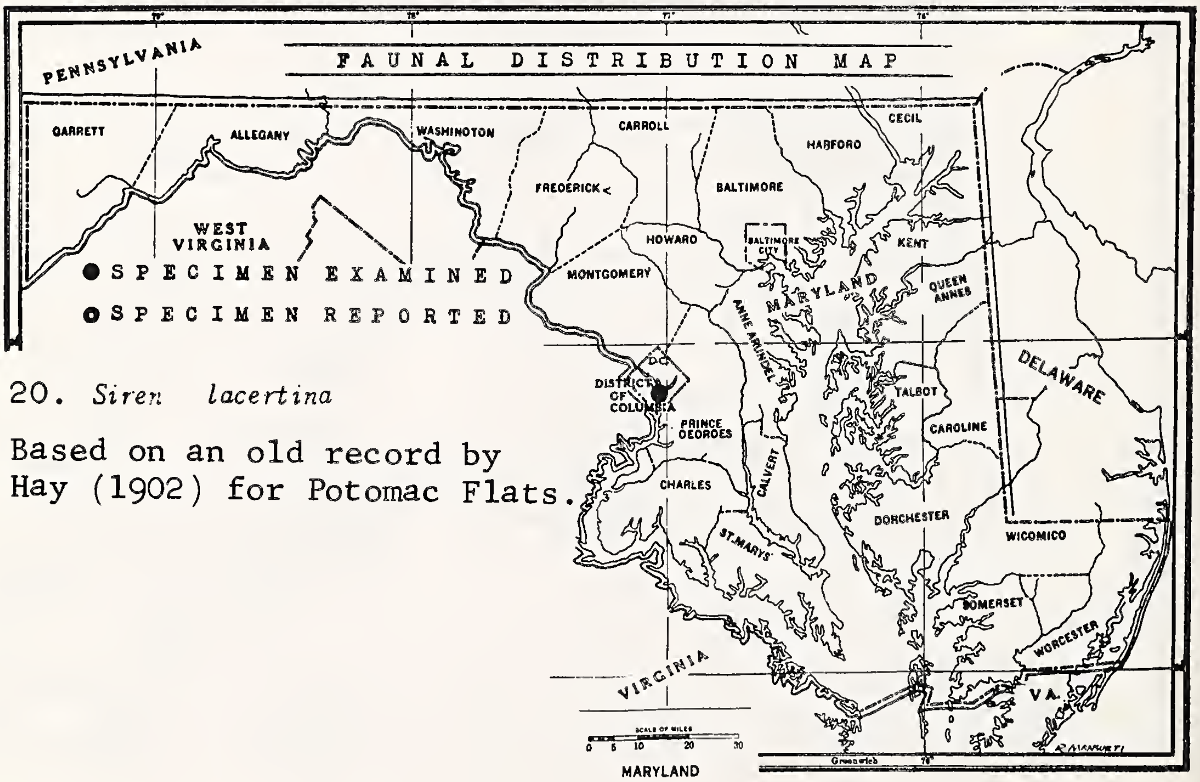
18. *Desmognathus o. ochrophaeus*

The Alleghany Plateau. Has been collected just off the plateau in a few streams.



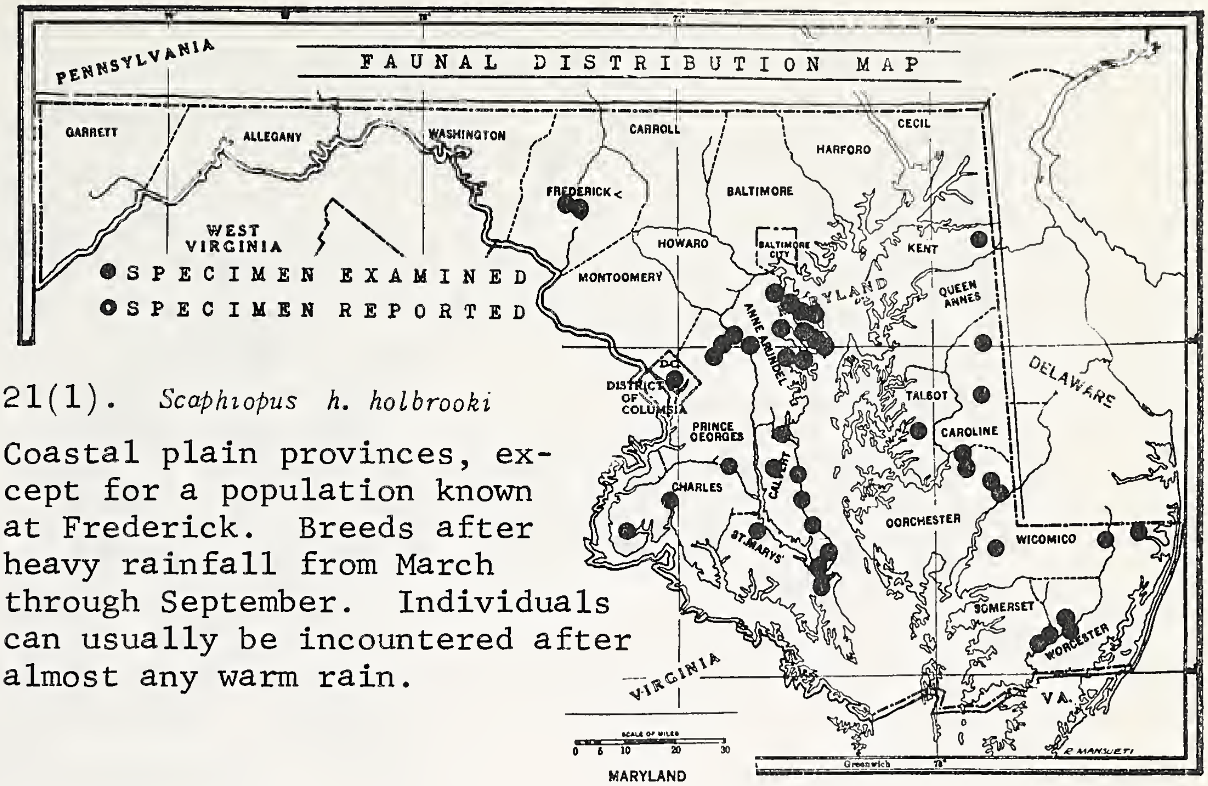
19. *Desmognathus m. monticloa*

The Alleghany Plateau. This salamander has also been taken just off the plateau in a few streams.



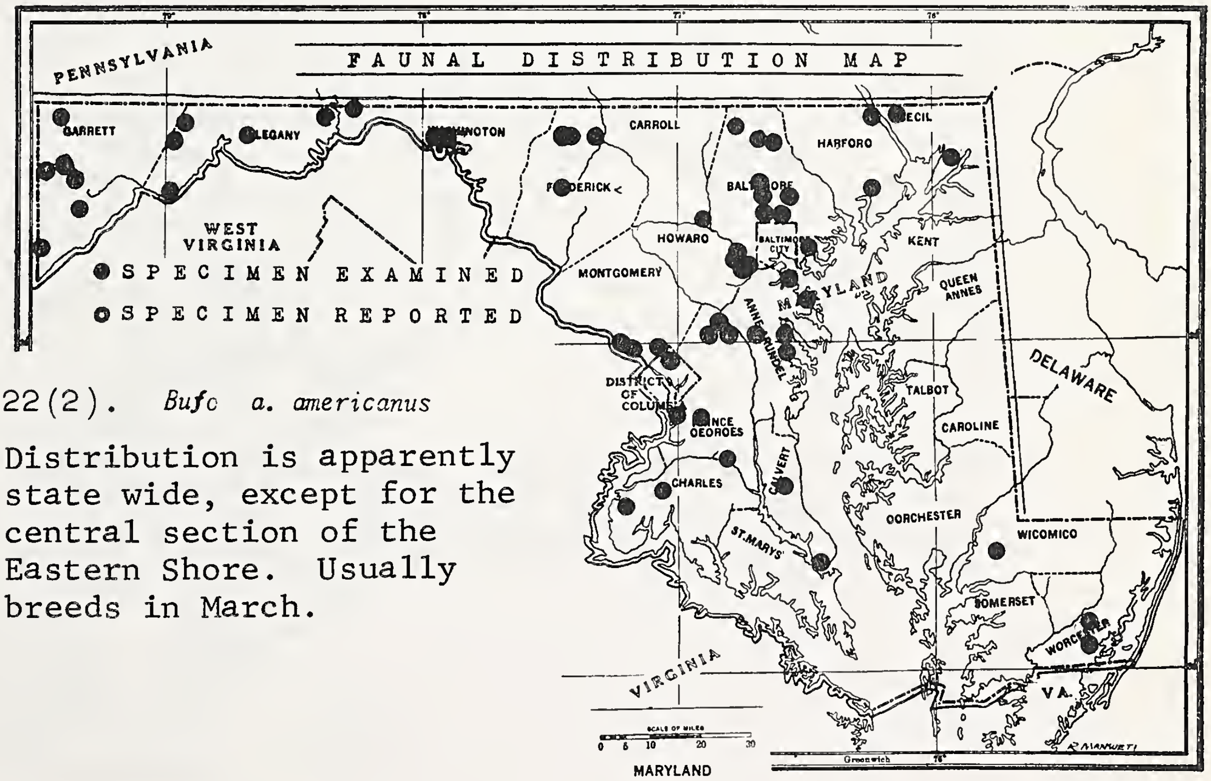
20. *Siren lacertina*

Based on an old record by Hay (1902) for Potomac Flats.



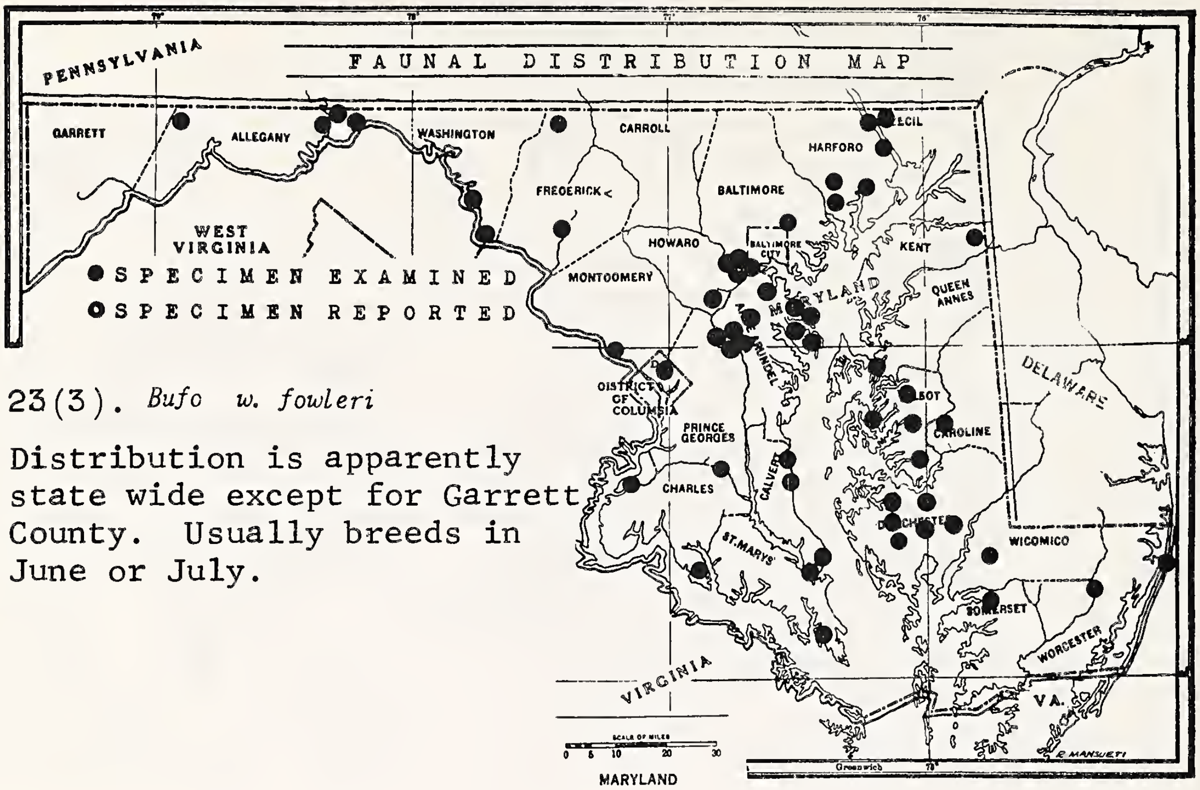
21(1). *Scaphiopus h. holbrooki*

Coastal plain provinces, except for a population known at Frederick. Breeds after heavy rainfall from March through September. Individuals can usually be incountered after almost any warm rain.



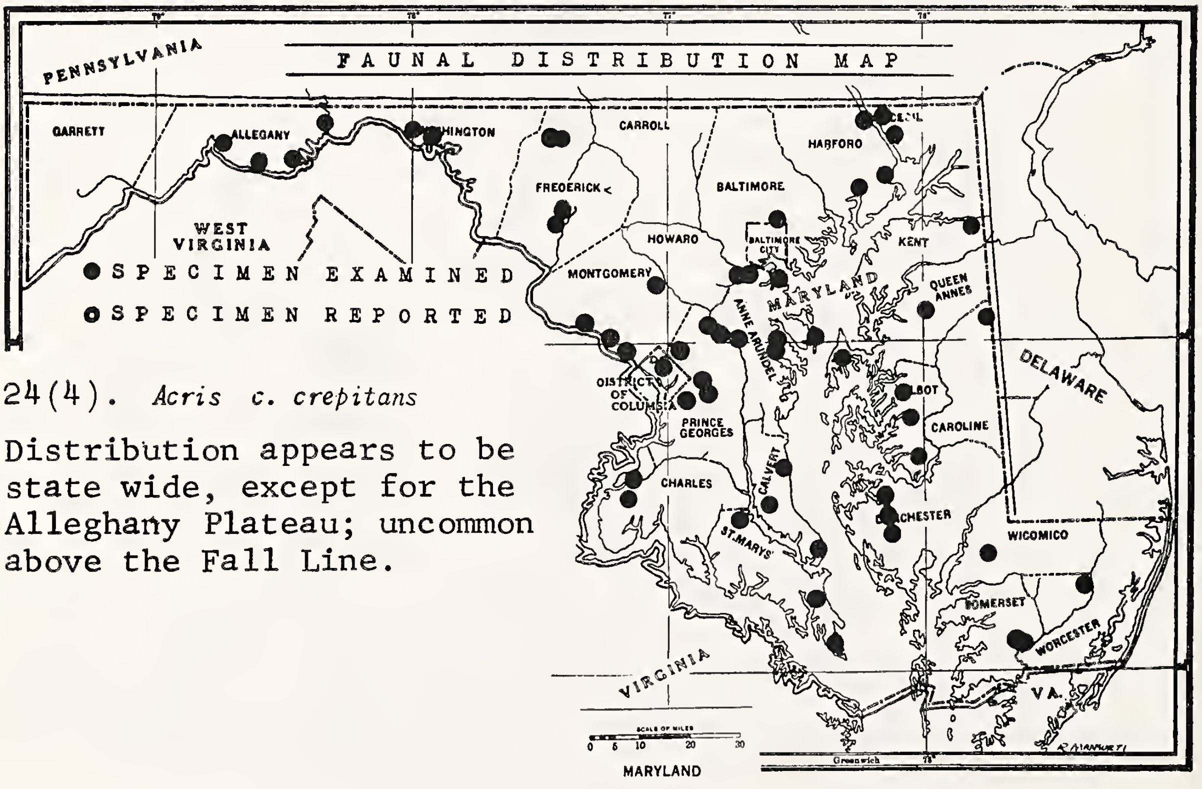
22(2). *Bufo a. americanus*

Distribution is apparently state wide, except for the central section of the Eastern Shore. Usually breeds in March.



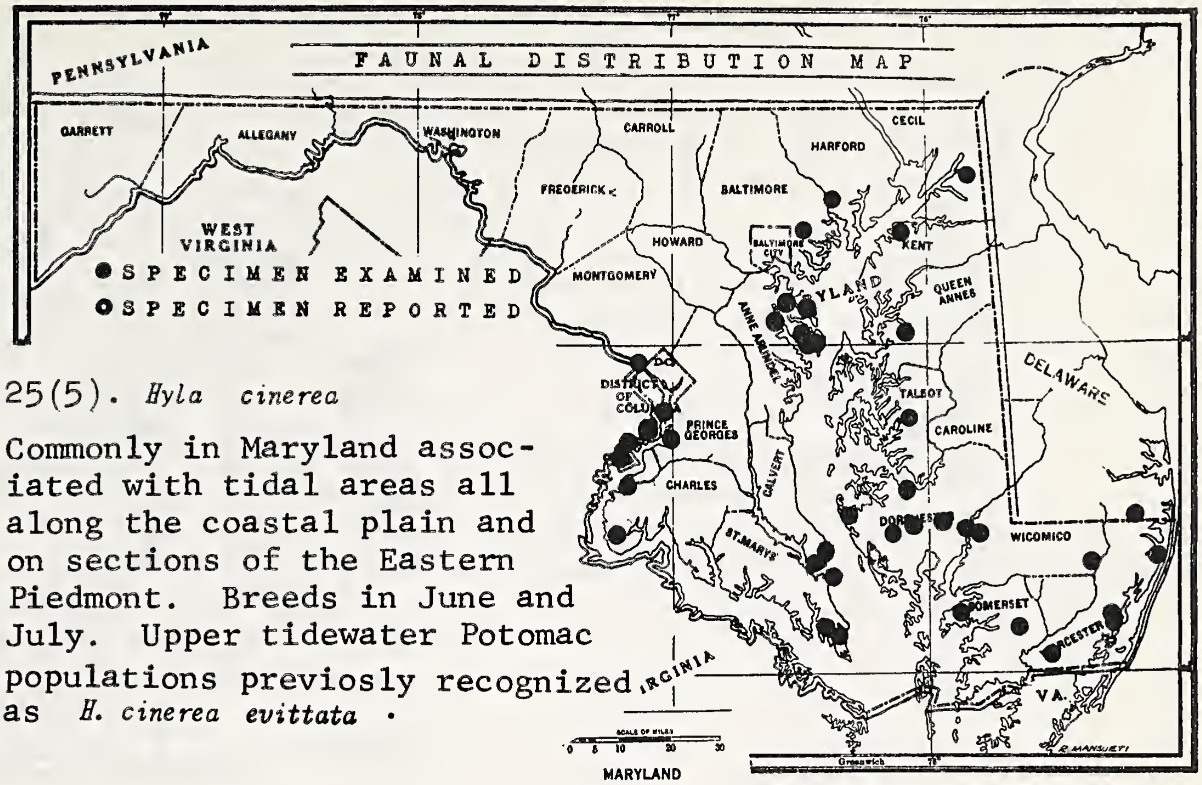
23(3). *Bufo w. fowleri*

Distribution is apparently state wide except for Garrett County. Usually breeds in June or July.



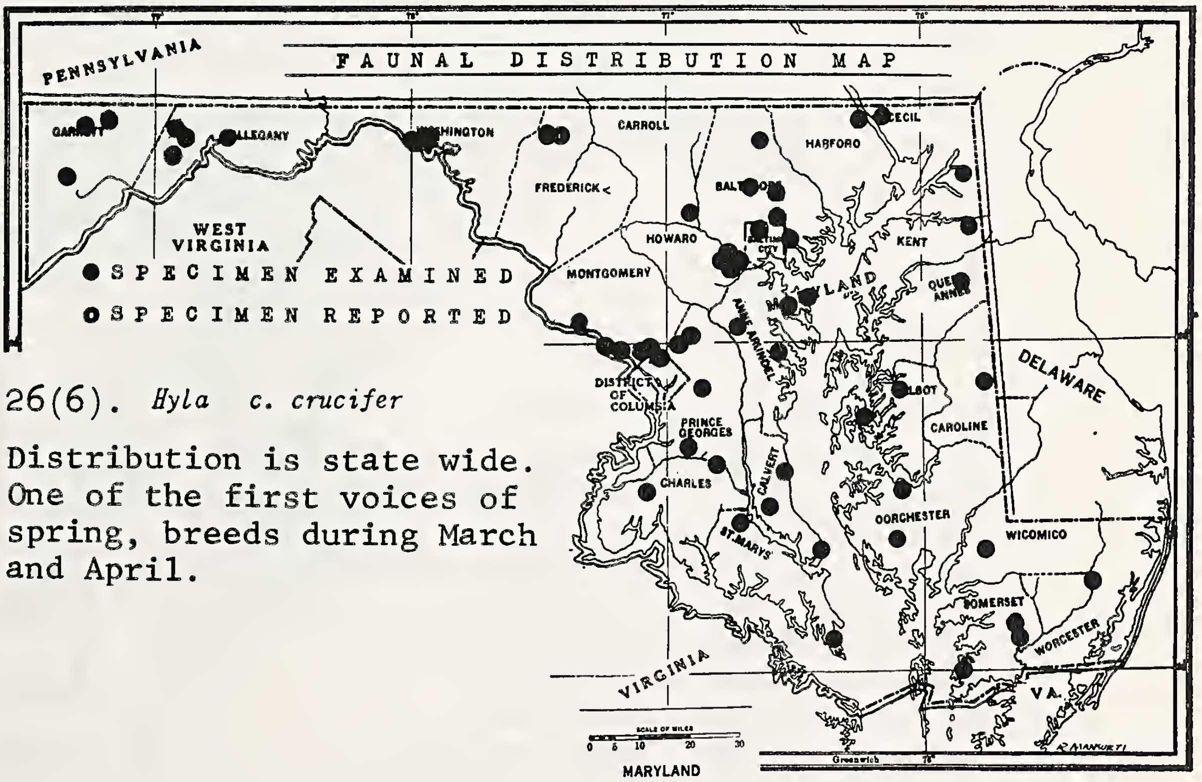
24(4). *Acris c. crepitans*

Distribution appears to be state wide, except for the Alleghany Plateau; uncommon above the Fall Line.



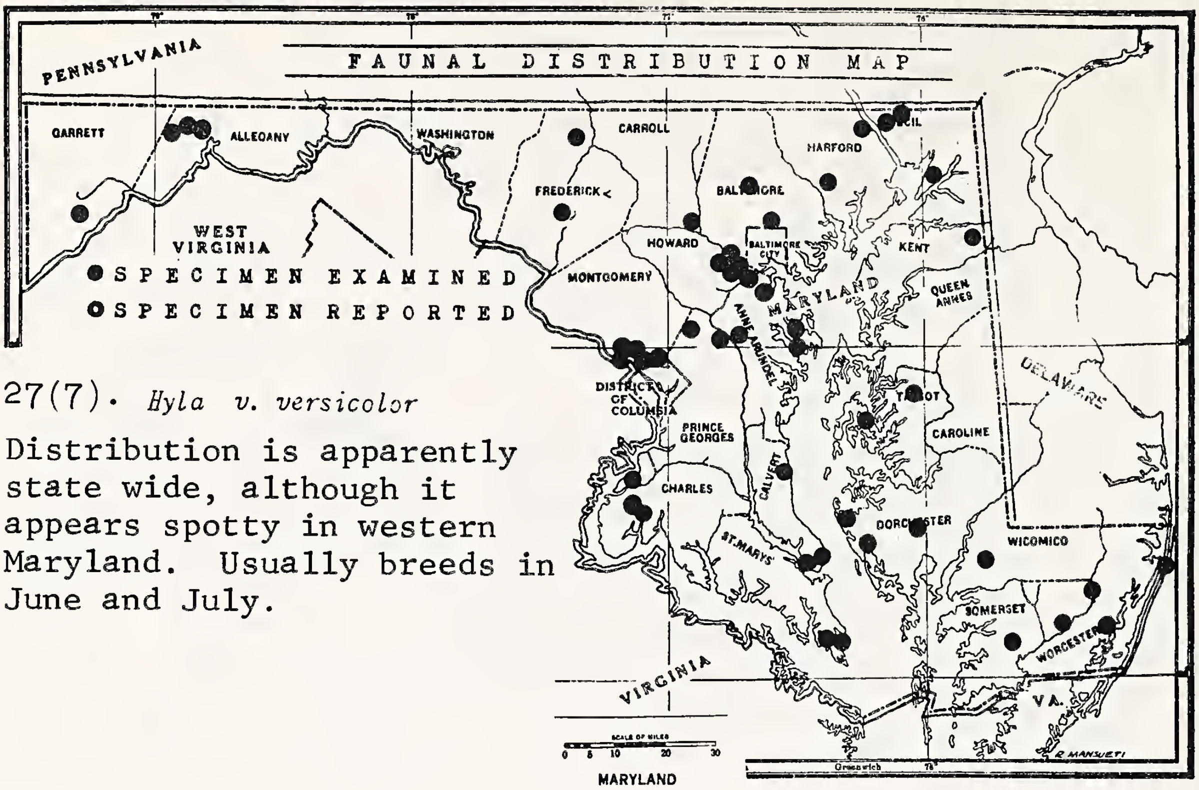
25(5). *Hyla cinerea*

Commonly in Maryland associated with tidal areas all along the coastal plain and on sections of the Eastern Piedmont. Breeds in June and July. Upper tidewater Potomac populations previosly recognized as *H. cinerea evittata* .



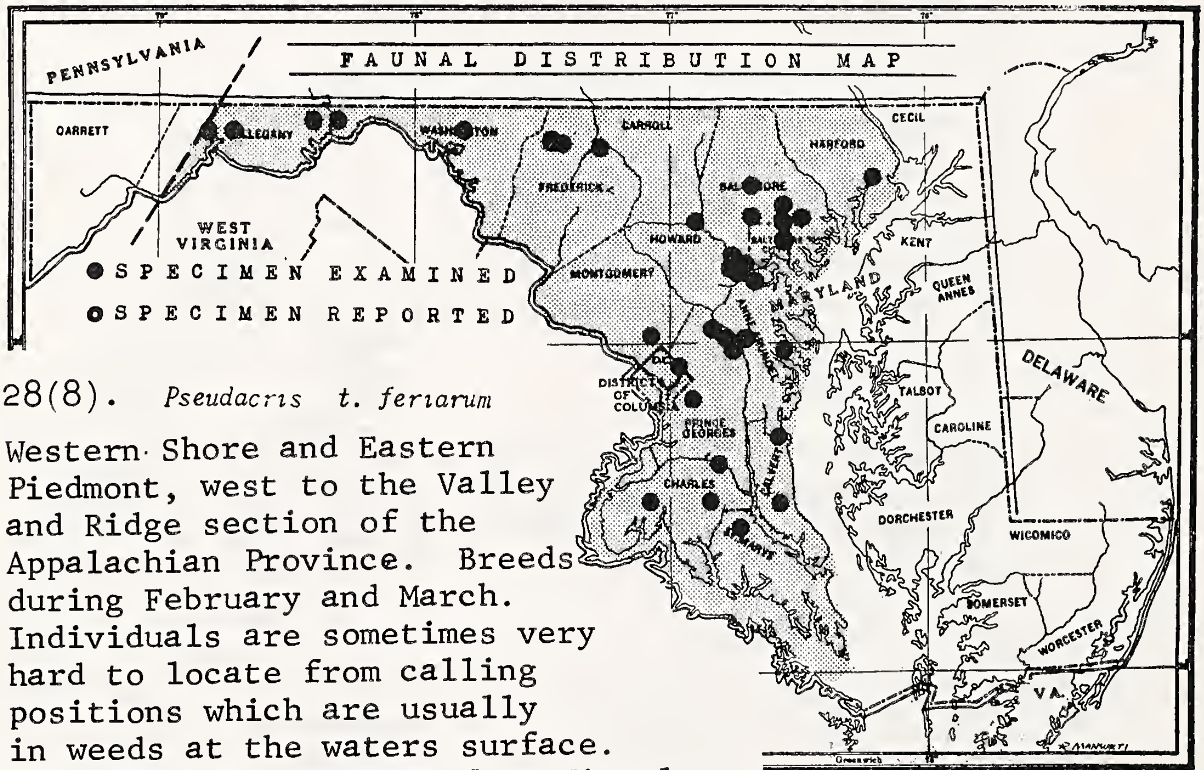
26(6). *Hyla c. crucifer*

Distribution is state wide. One of the first voices of spring, breeds during March and April.



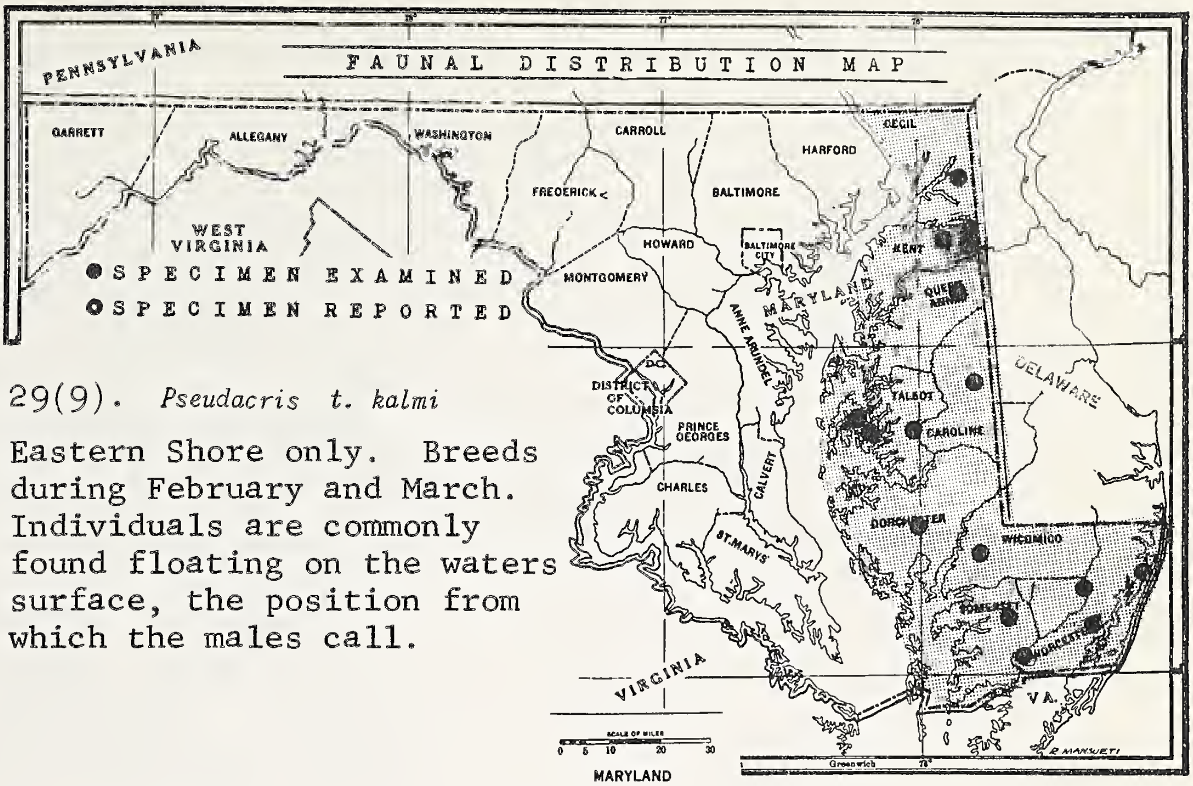
27(7). *Hyla v. versicolor*

Distribution is apparently state wide, although it appears spotty in western Maryland. Usually breeds in June and July.



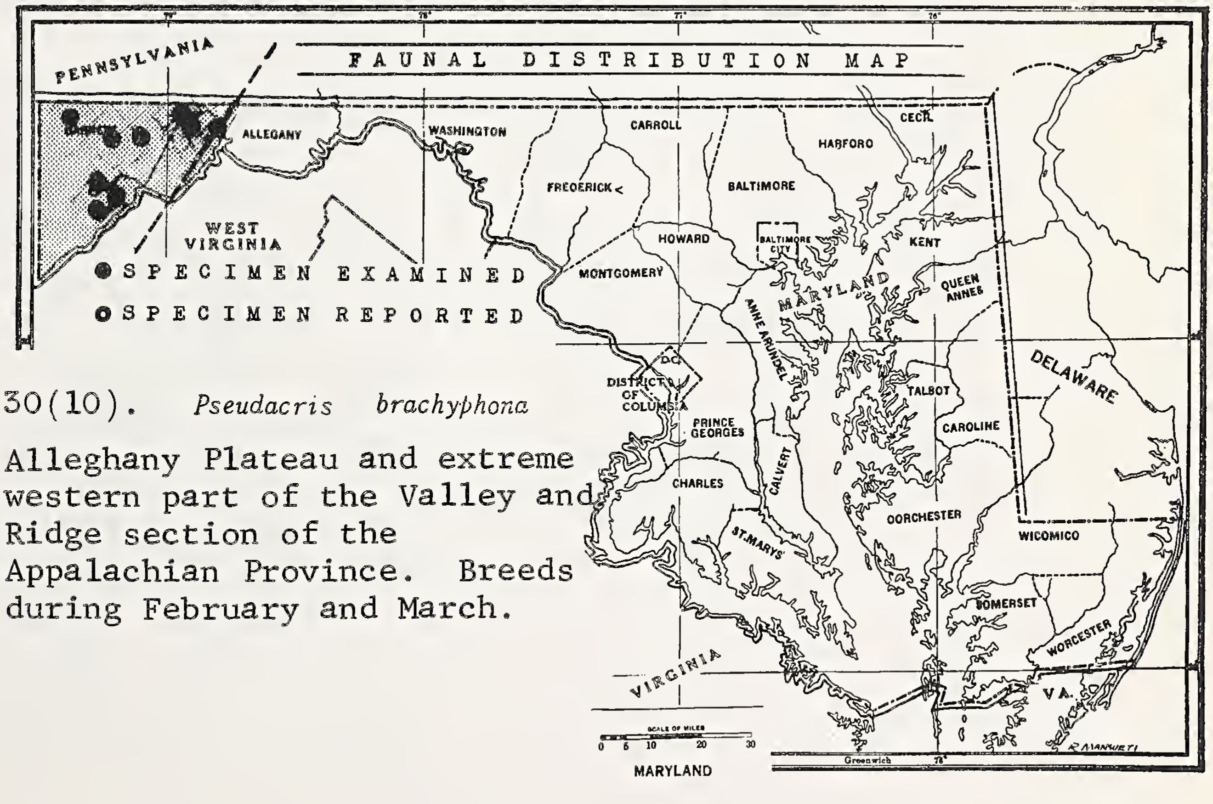
28(8). *Pseudacris t. feriarum*

Western Shore and Eastern Piedmont, west to the Valley and Ridge section of the Appalachian Province. Breeds during February and March. Individuals are sometimes very hard to locate from calling positions which are usually in weeds at the waters surface. A specimen in the USNM from Finzel Garrett Co., is not *P. t. feriarum* but *P. brachyphona* (Franz,1967).



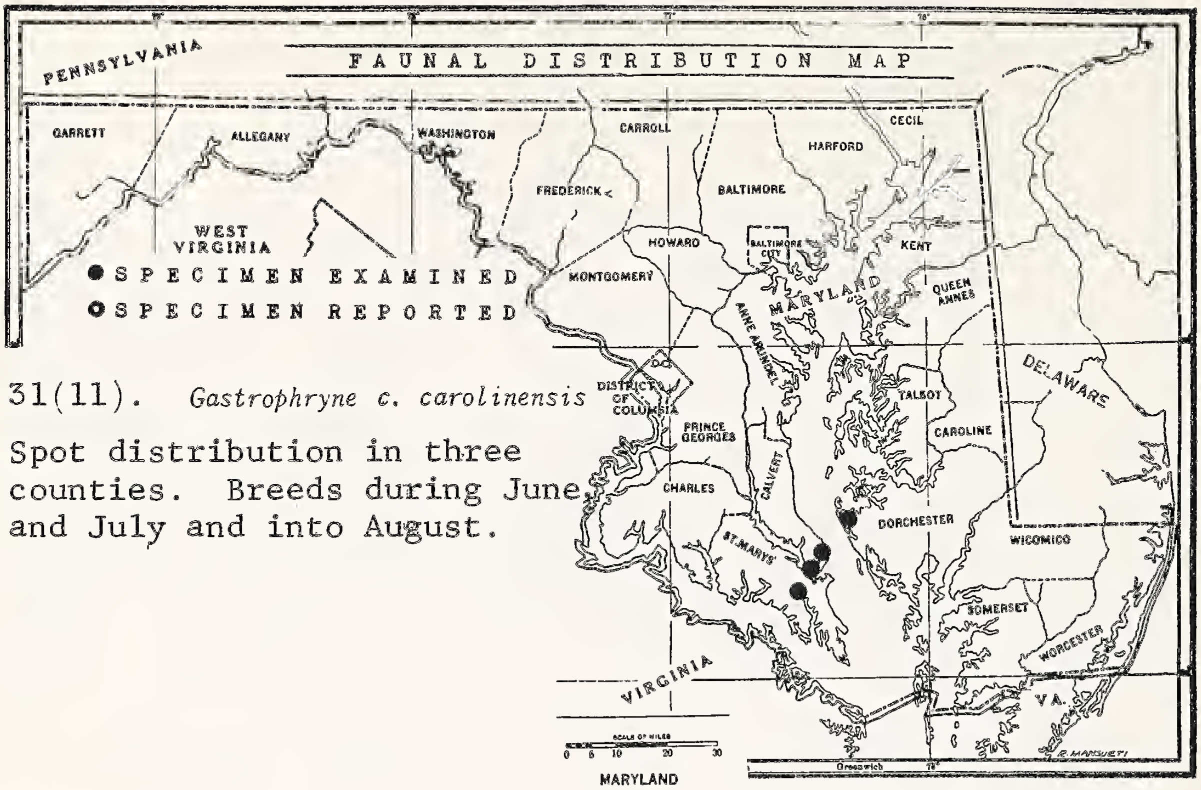
29(9). *Pseudacris t. kalmi*

Eastern Shore only. Breeds during February and March. Individuals are commonly found floating on the waters surface, the position from which the males call.



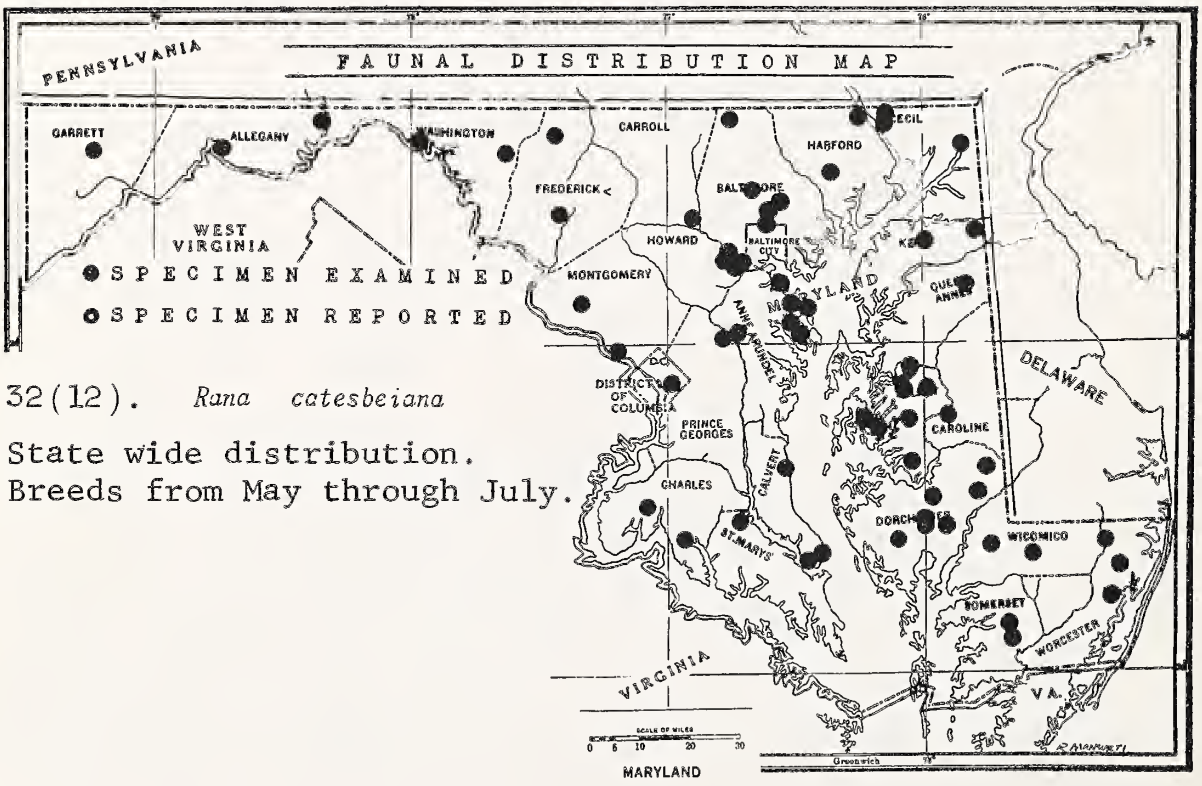
30(10). *Pseudacris brachyphona*

Alleghany Plateau and extreme western part of the Valley and Ridge section of the Appalachian Province. Breeds during February and March.



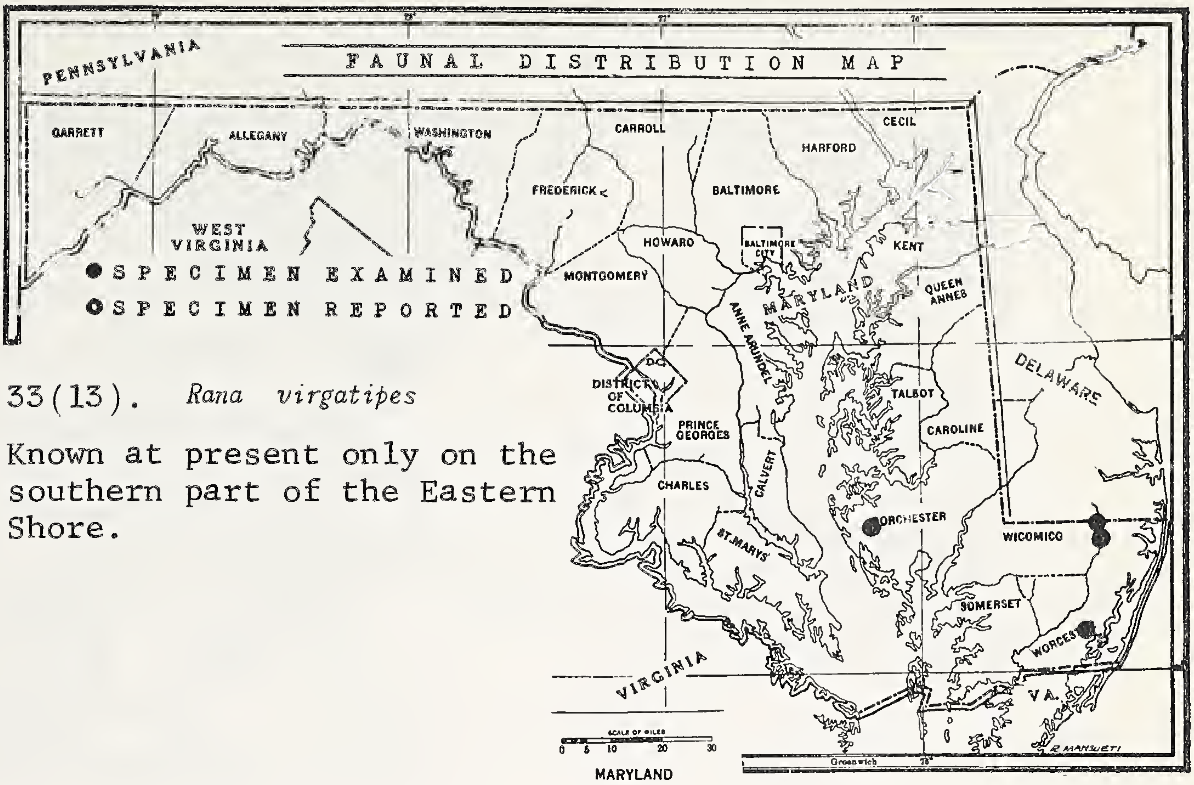
31(11). *Gastrophryne c. carolinensis*

Spot distribution in three counties. Breeds during June and July and into August.



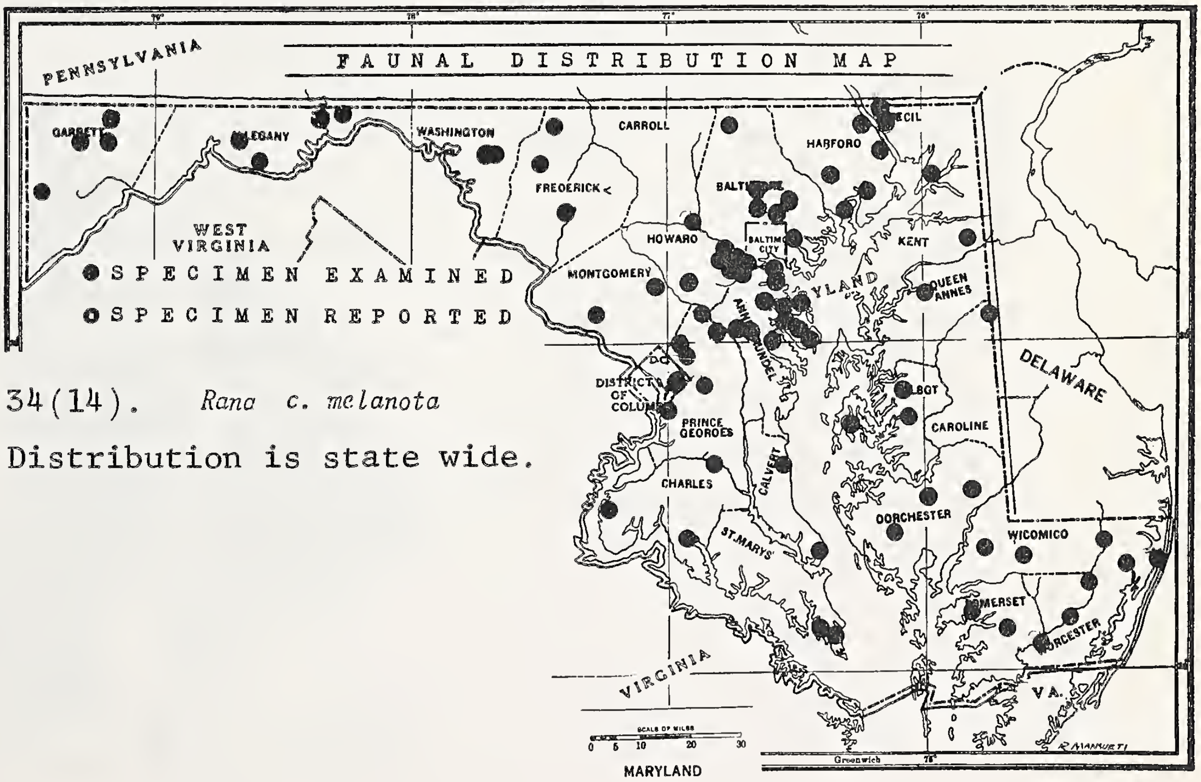
32(12). *Rana catesbeiana*

State wide distribution. Breeds from May through July.



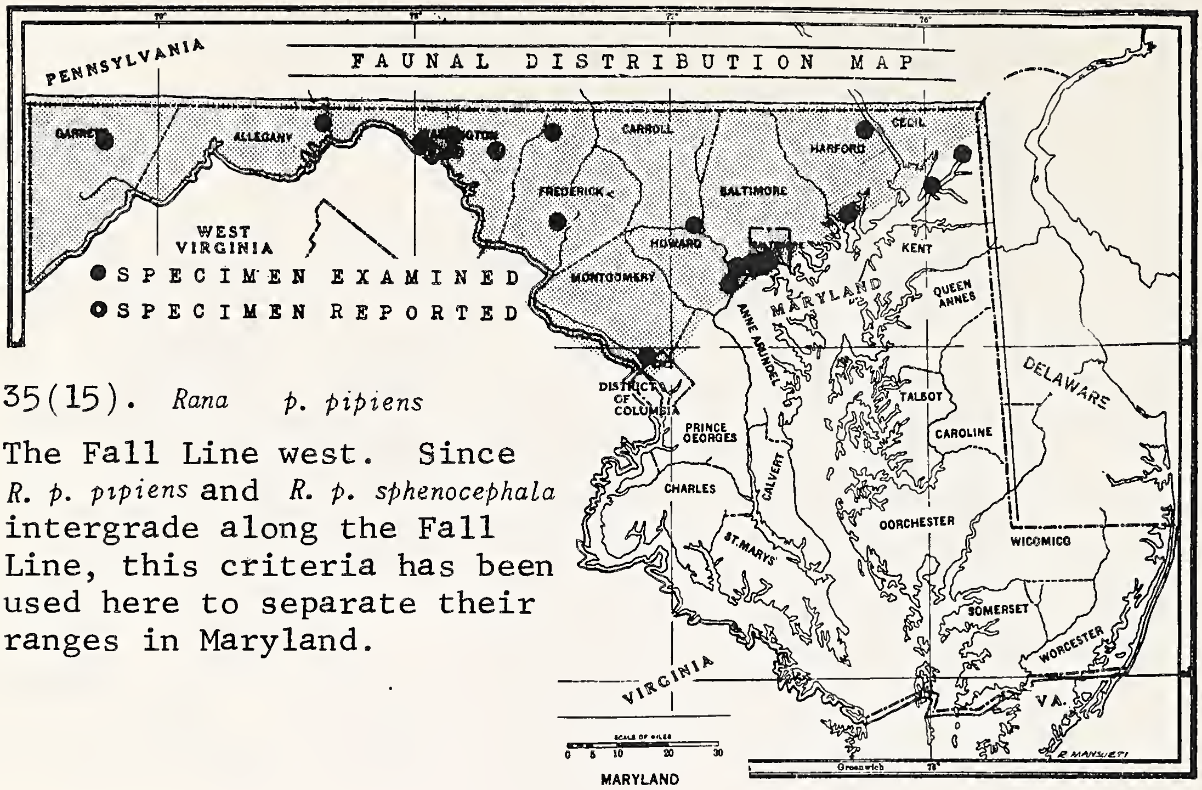
33(13). *Rana virgatipes*

Known at present only on the southern part of the Eastern Shore.



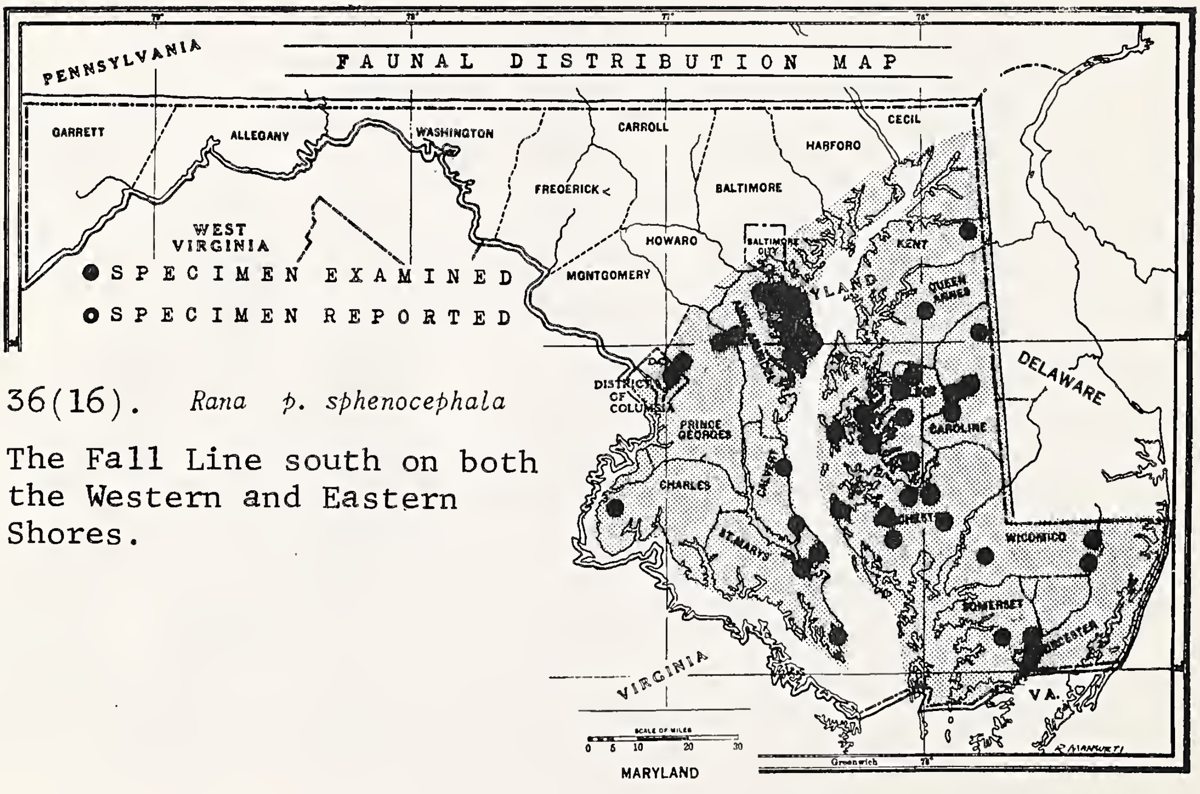
34(14). *Rana c. melanota*

Distribution is state wide.



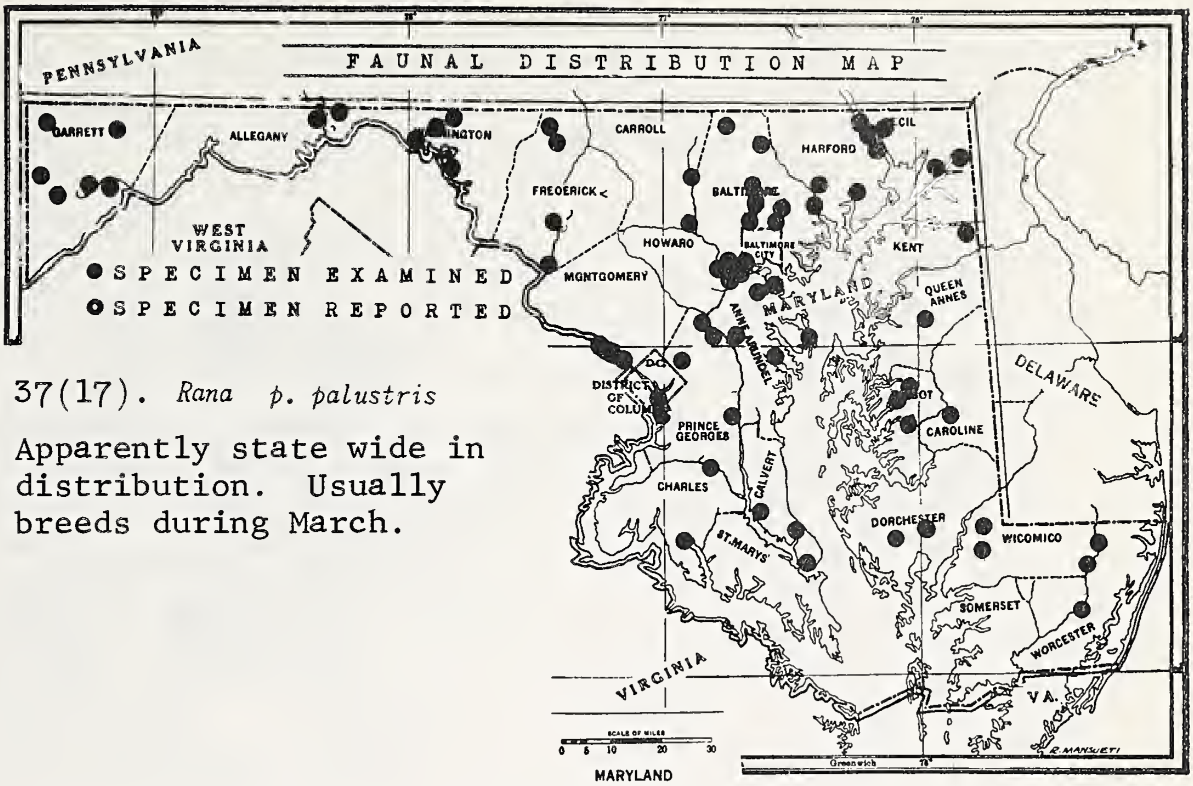
35(15). *Rana p. pipiens*

The Fall Line west. Since *R. p. pipiens* and *R. p. sphenocephala* intergrade along the Fall Line, this criteria has been used here to separate their ranges in Maryland.



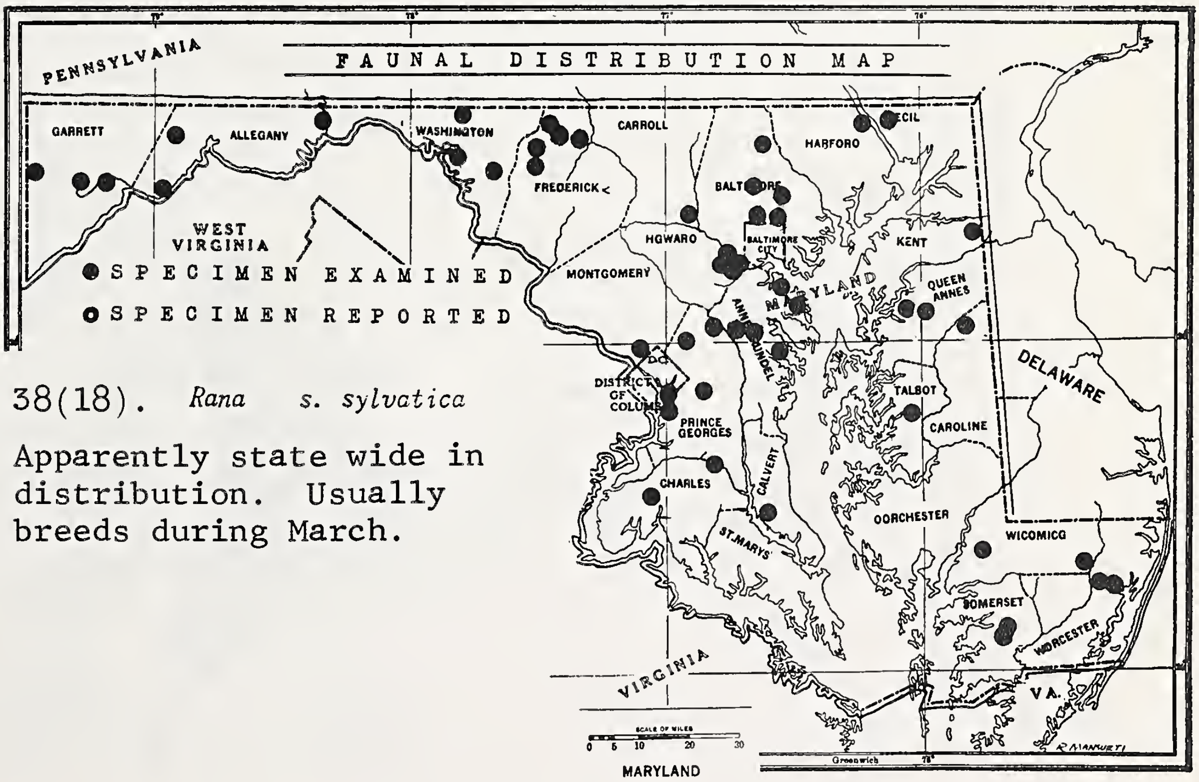
36(16). *Rana p. sphenocephala*

The Fall Line south on both the Western and Eastern Shores.



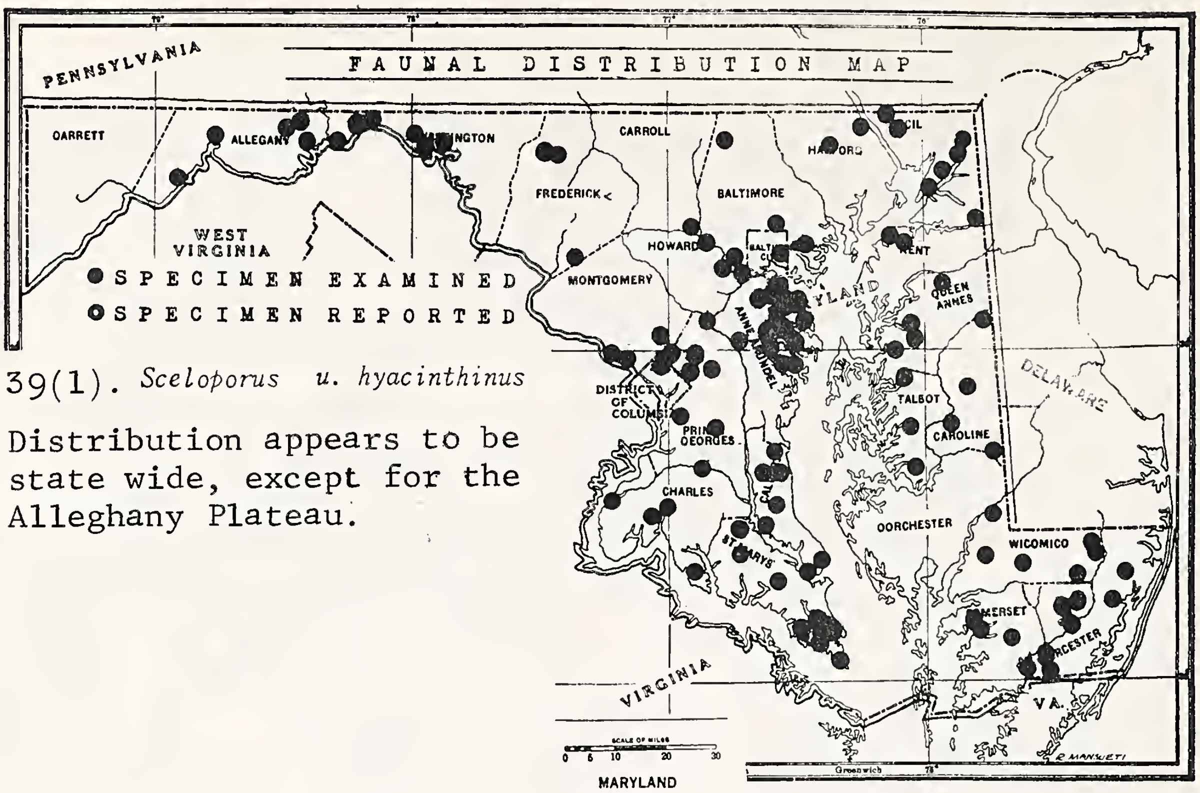
37(17). *Rana p. palustris*

Apparently state wide in distribution. Usually breeds during March.



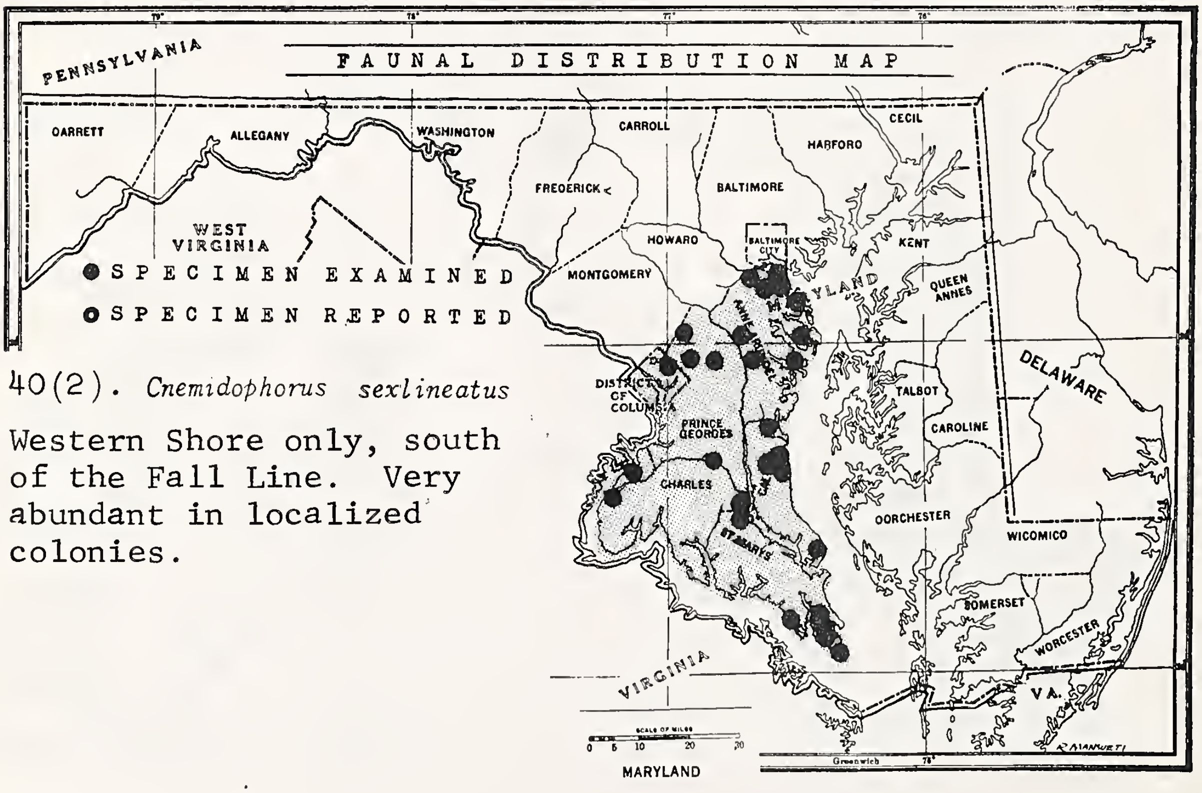
38(18). *Rana s. sylvatica*

Apparently state wide in distribution. Usually breeds during March.



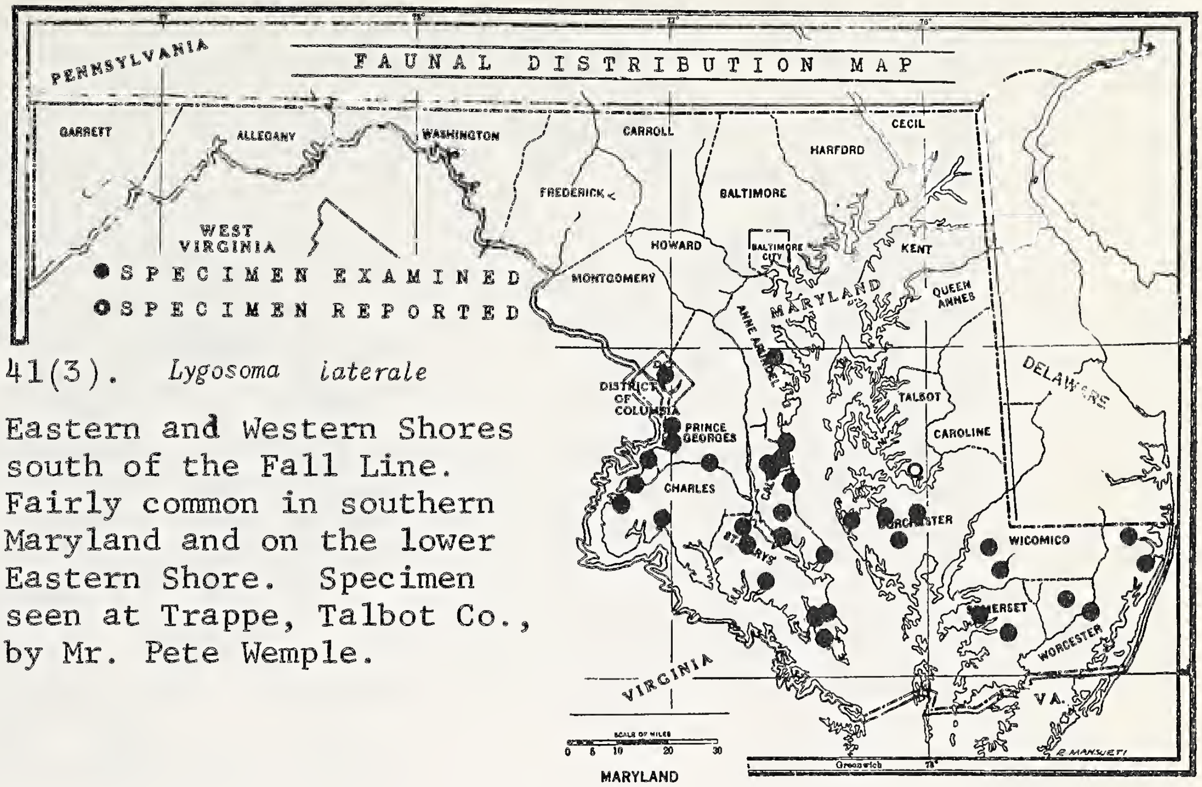
39(1). *Sceloporus u. hyacinthinus*

Distribution appears to be state wide, except for the Alleghany Plateau.



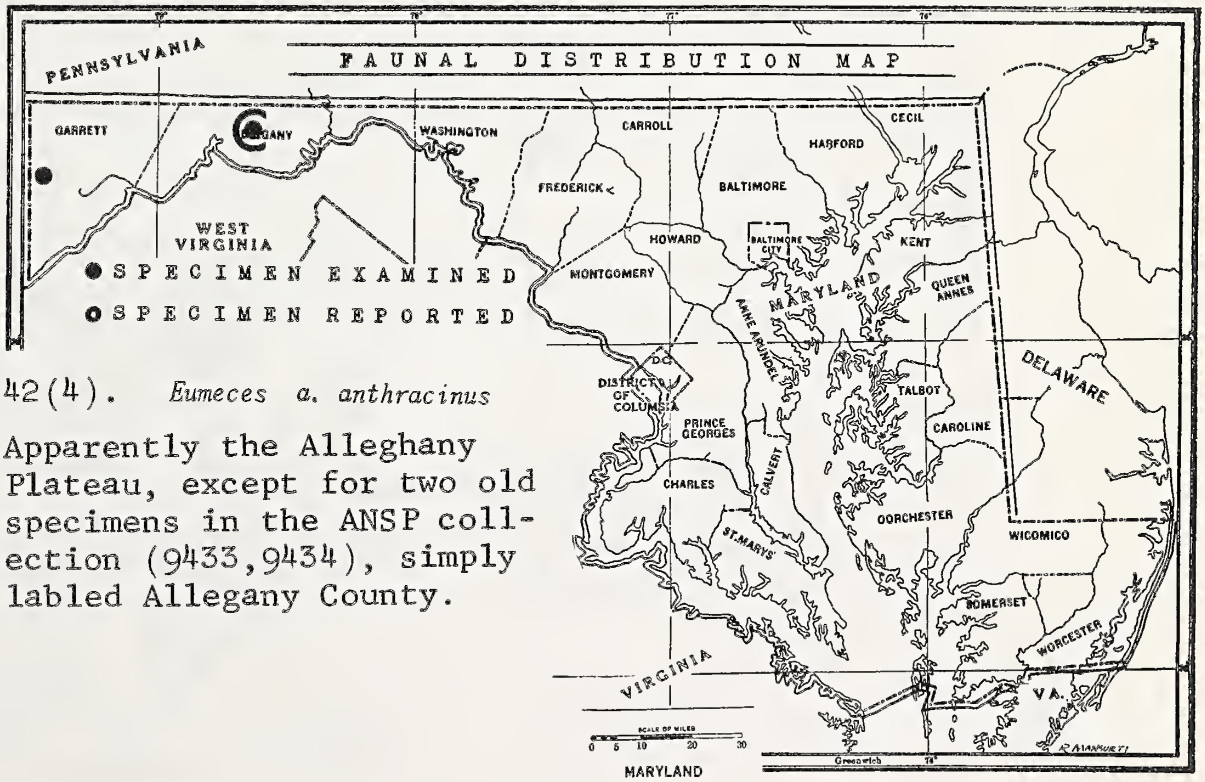
40(2). *Cnemidophorus sexlineatus*

Western Shore only, south of the Fall Line. Very abundant in localized colonies.



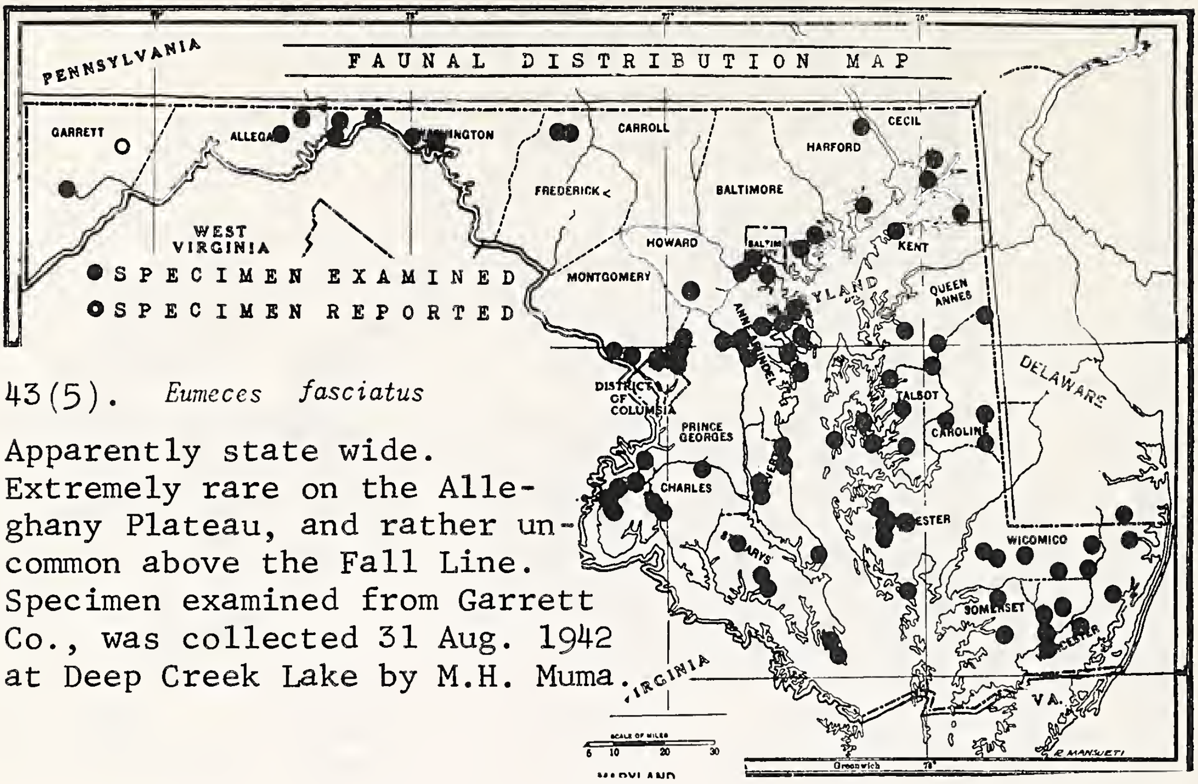
41(3). *Lygosoma laterale*

Eastern and Western Shores south of the Fall Line. Fairly common in southern Maryland and on the lower Eastern Shore. Specimen seen at Trappe, Talbot Co., by Mr. Pete Wemple.



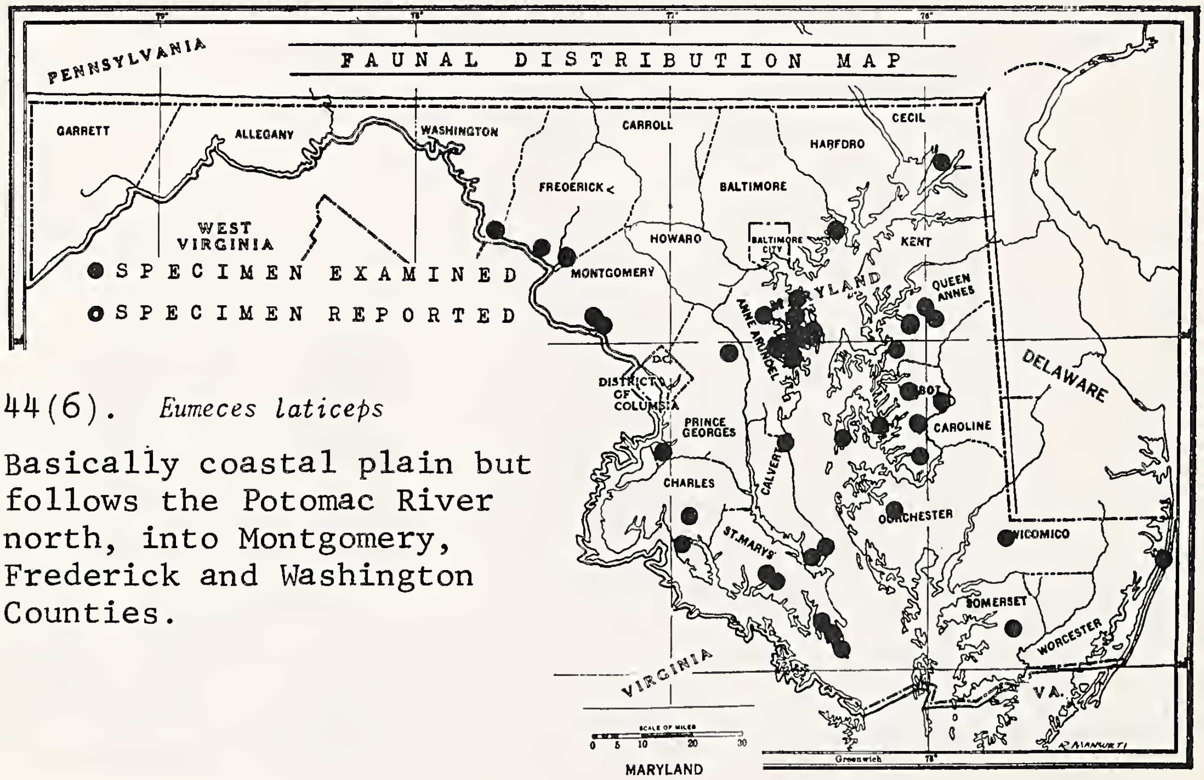
42(4). *Eumeces a. anthracinus*

Apparently the Alleghany Plateau, except for two old specimens in the ANSP collection (9433,9434), simply labled Allegany County.



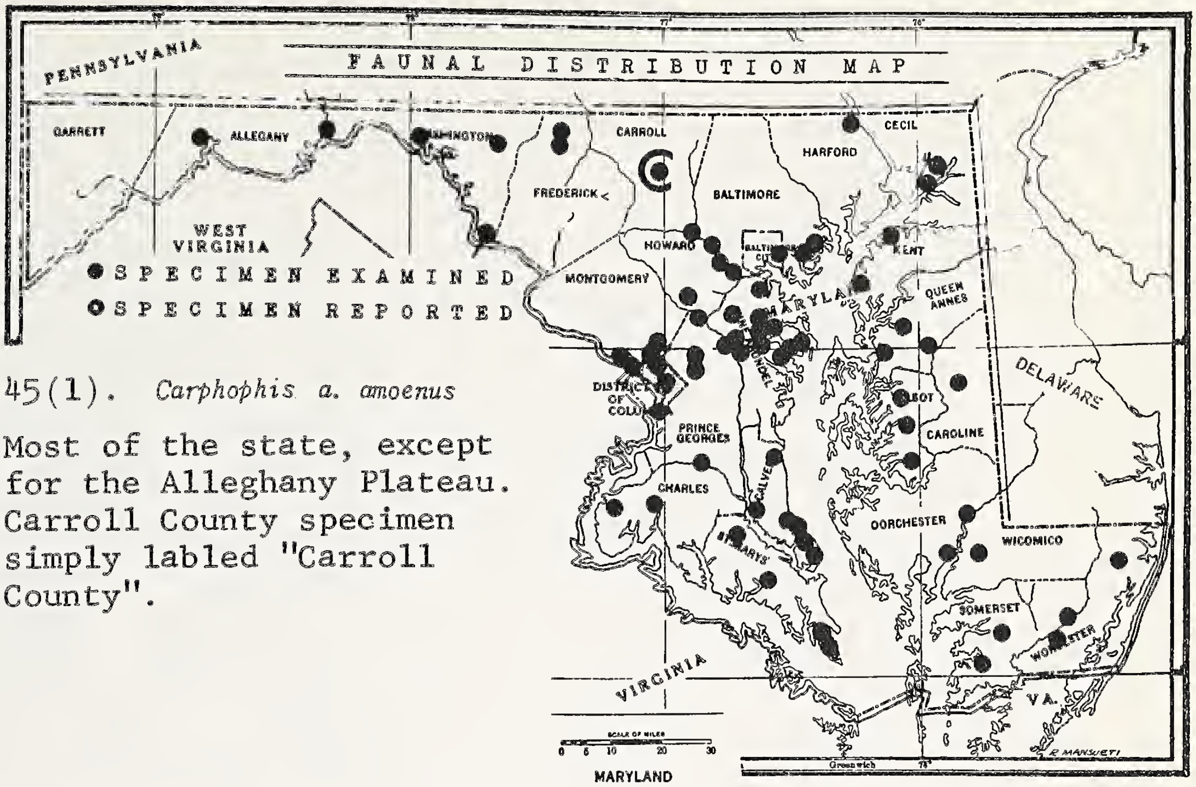
43(5). *Eumeces fasciatus*

Apparently state wide. Extremely rare on the Alleghany Plateau, and rather uncommon above the Fall Line. Specimen examined from Garrett Co., was collected 31 Aug. 1942 at Deep Creek Lake by M.H. Muma.



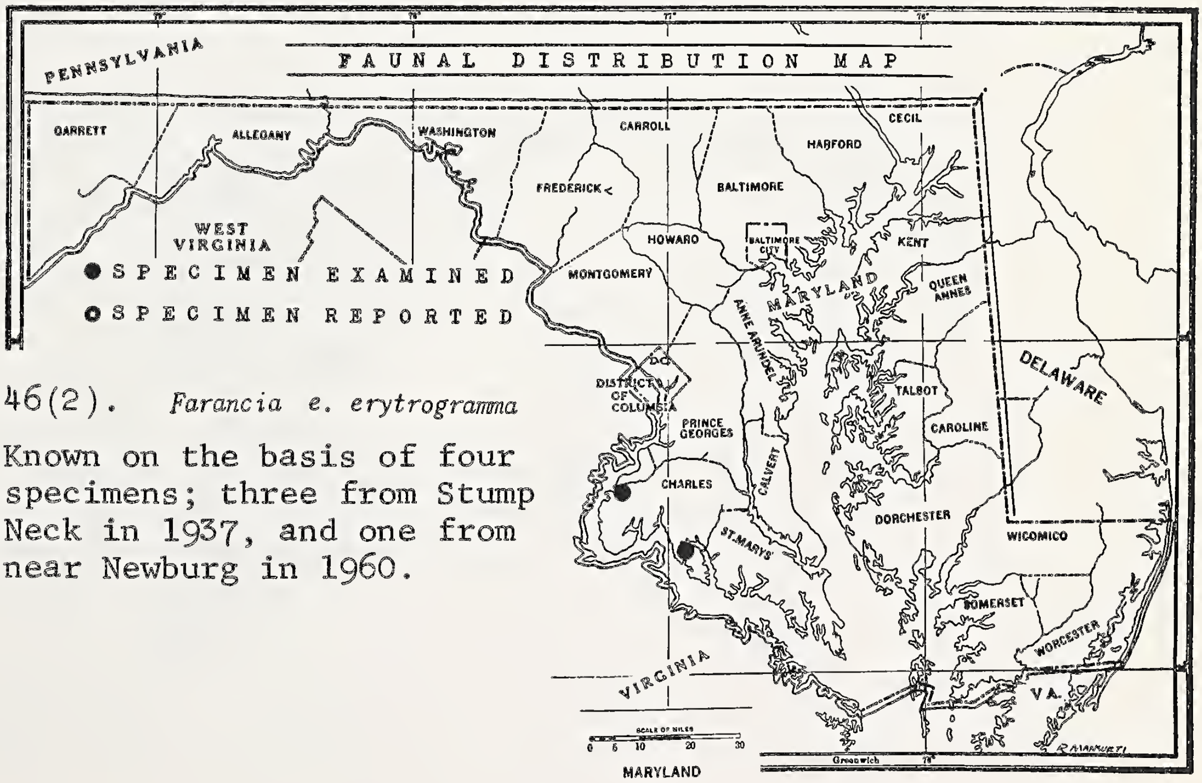
44(6). *Eumeces laticeps*

Basically coastal plain but follows the Potomac River north, into Montgomery, Frederick and Washington Counties.



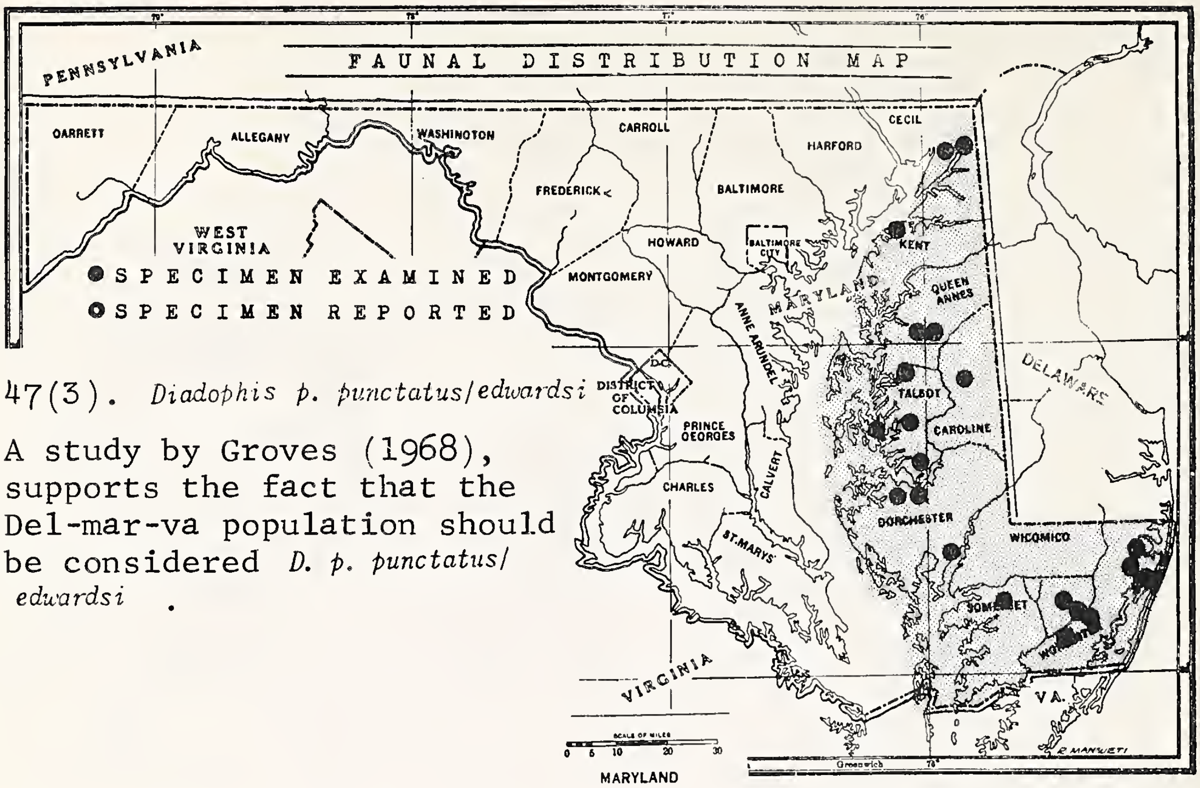
45(1). *Carphophis a. amoenus*

Most of the state, except for the Alleghany Plateau. Carroll County specimen simply labled "Carroll County".



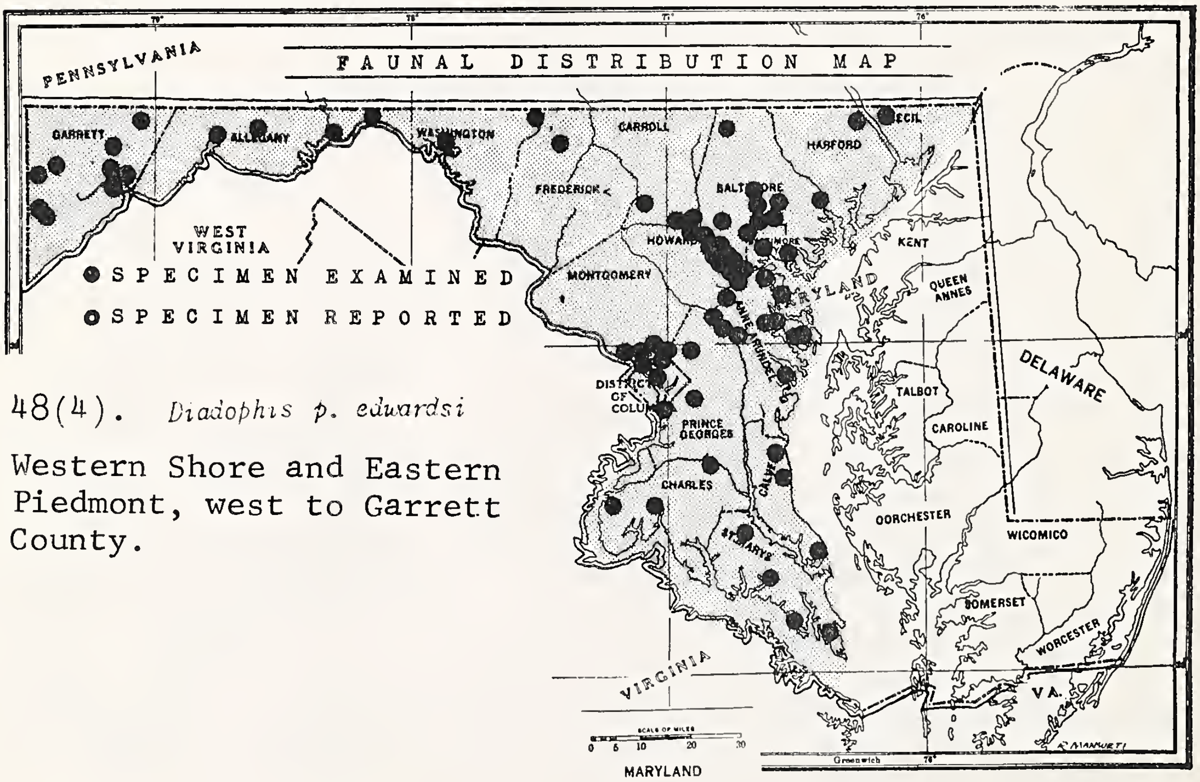
46(2). *Farancia e. erytrogramma*

Known on the basis of four specimens; three from Stump Neck in 1937, and one from near Newburg in 1960.



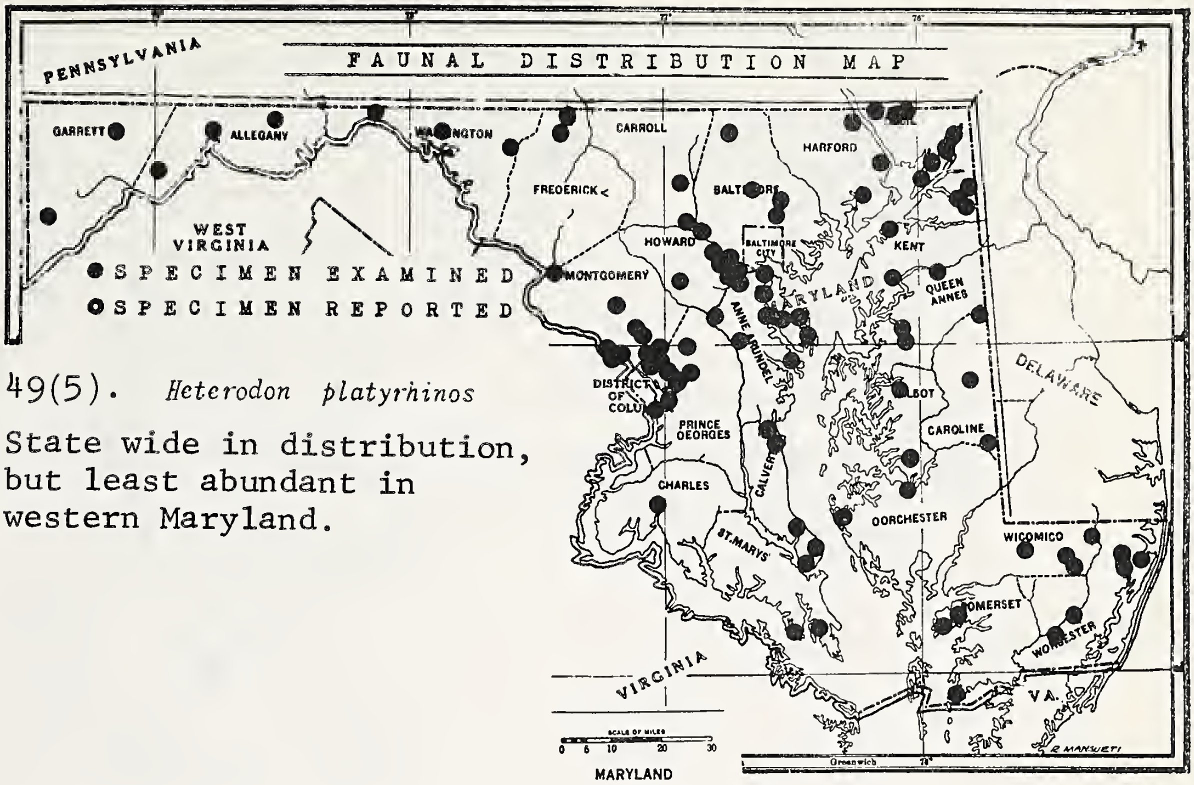
47(3). *Diadophis p. punctatus/edwardsi*

A study by Groves (1968), supports the fact that the Del-mar-va population should be considered *D. p. punctatus/ edwardsi* .



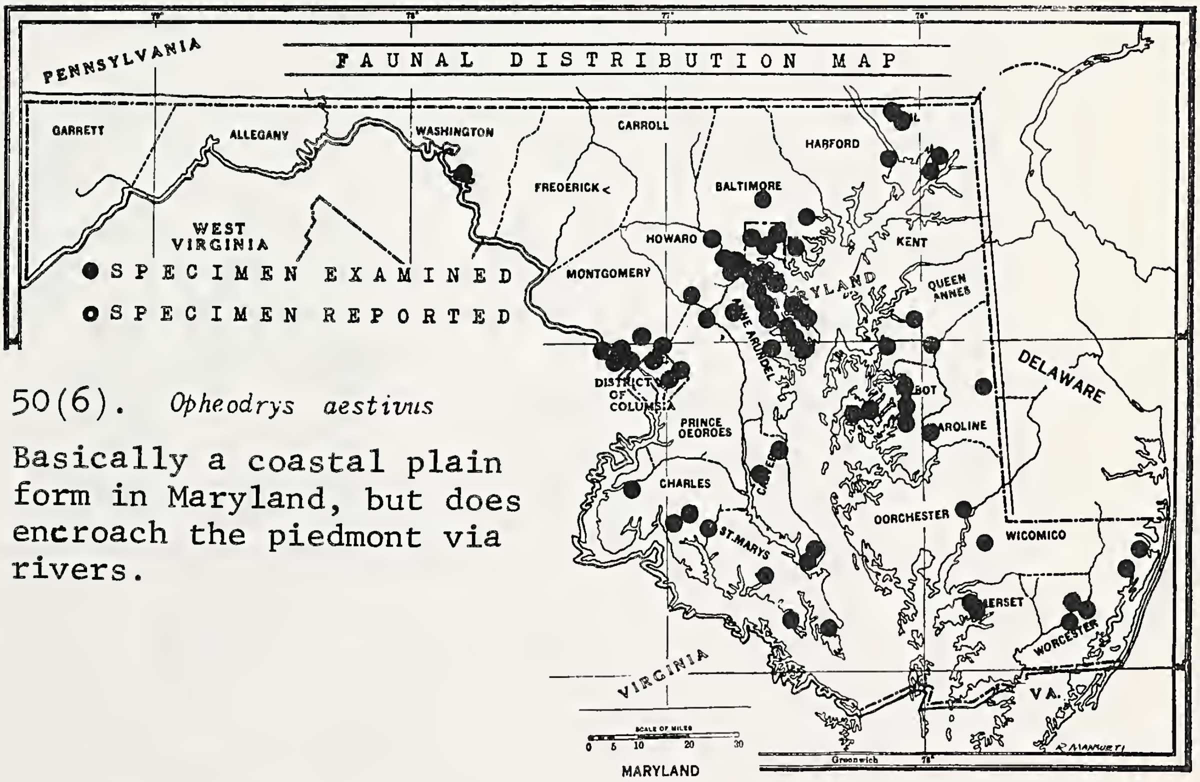
48(4). *Diadophis p. edwardsi*

Western Shore and Eastern Piedmont, west to Garrett County.



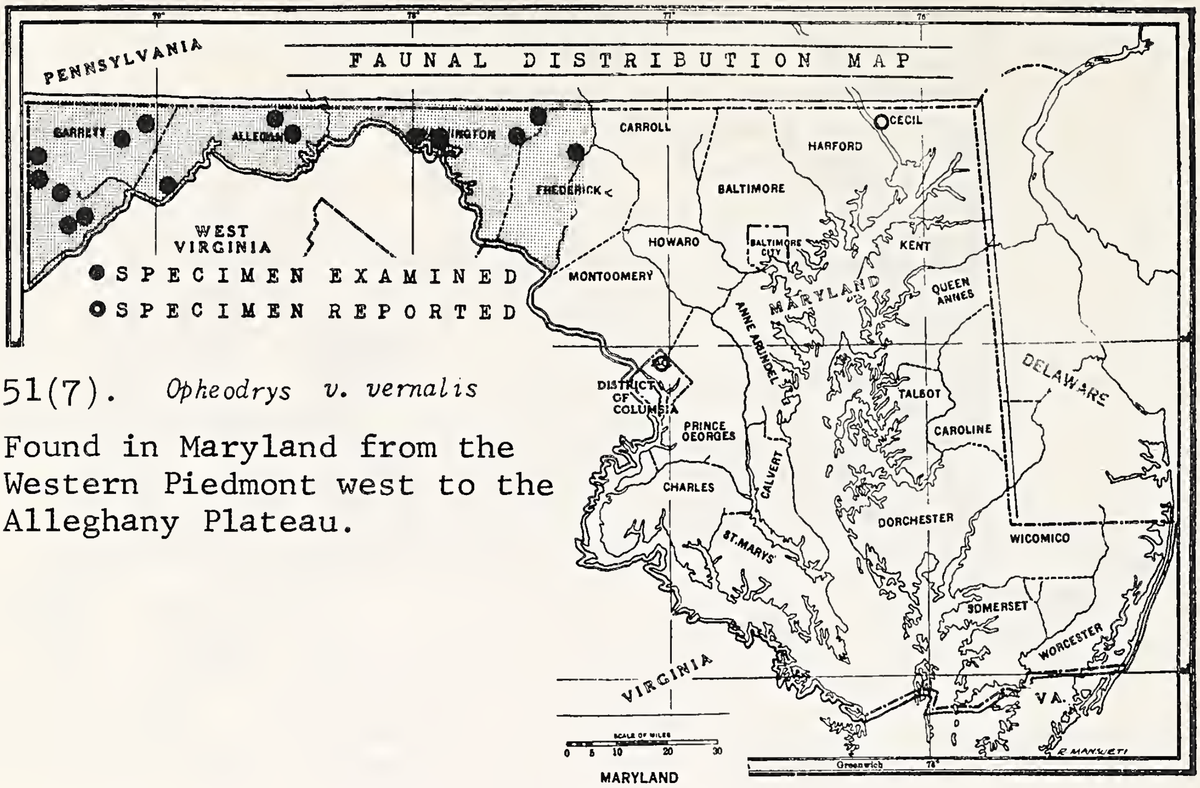
49(5). *Heterodon platyrhinos*

State wide in distribution, but least abundant in western Maryland.



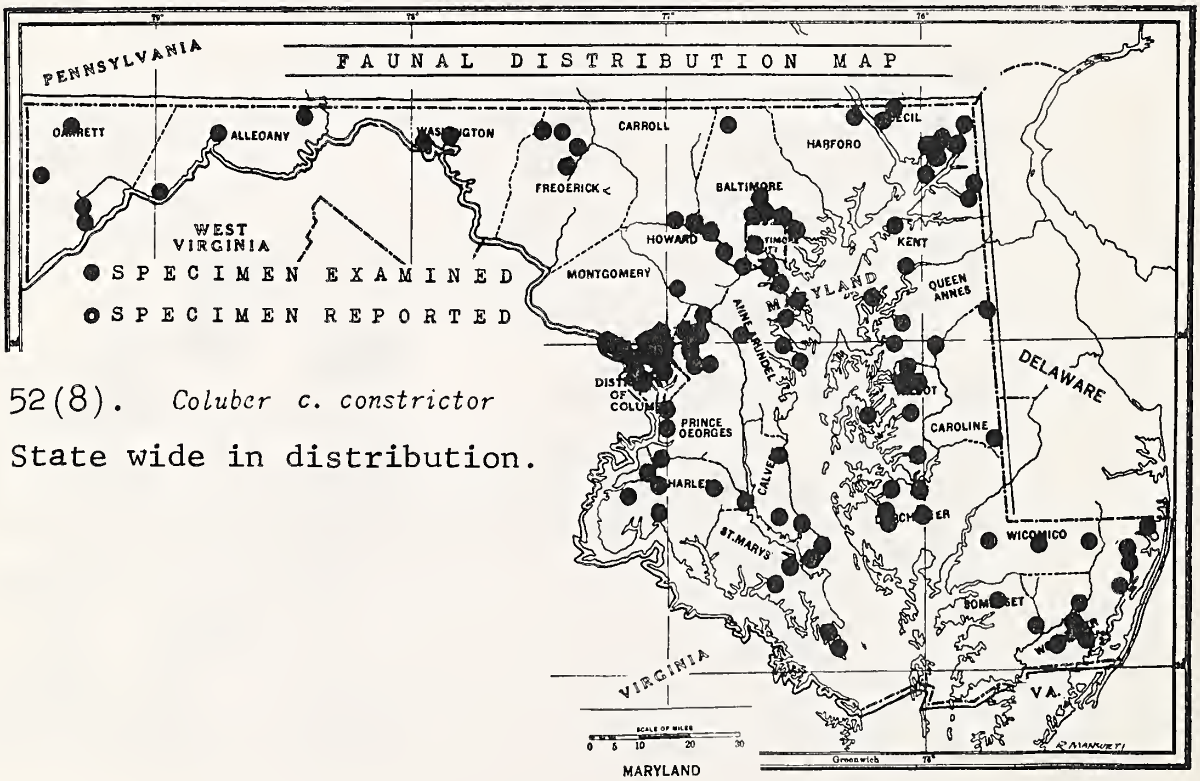
50(6). *Opheodrys aestivus*

Basically a coastal plain form in Maryland, but does encroach the piedmont via rivers.



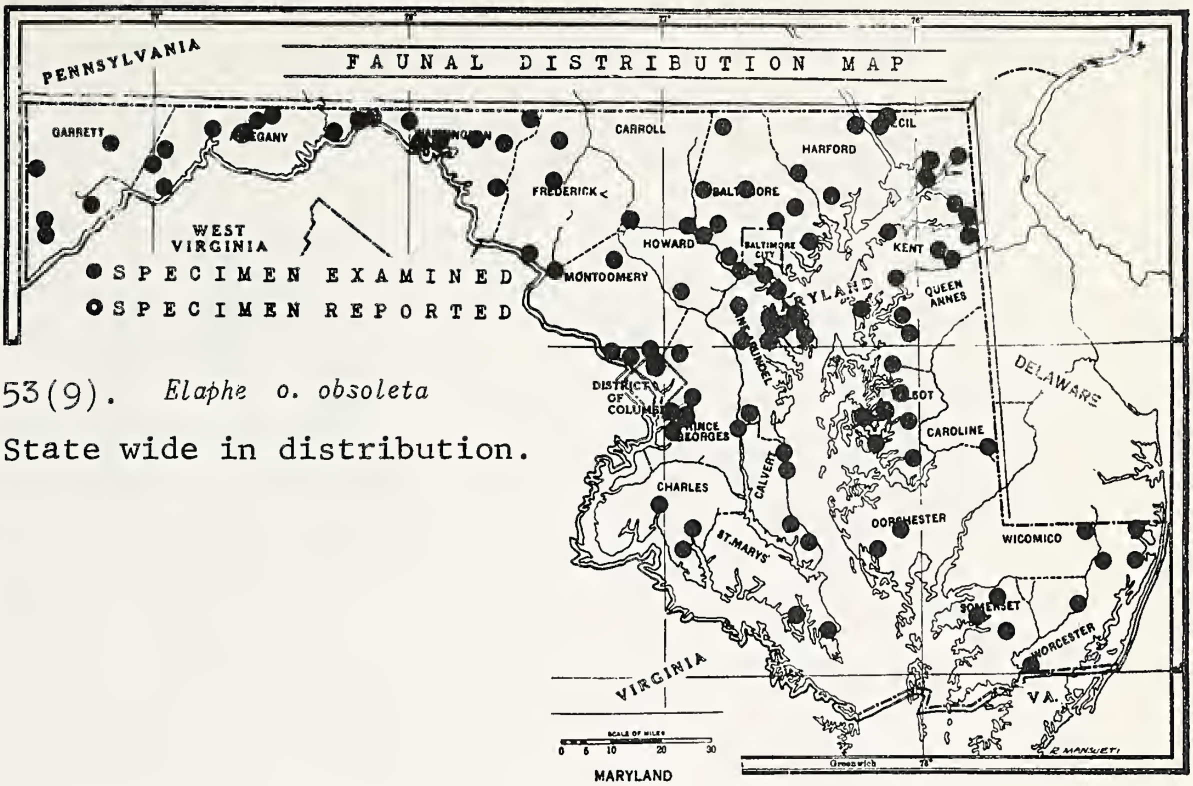
51(7). *Opheodrys v. vernalis*

Found in Maryland from the Western Piedmont west to the Alleghany Plateau.



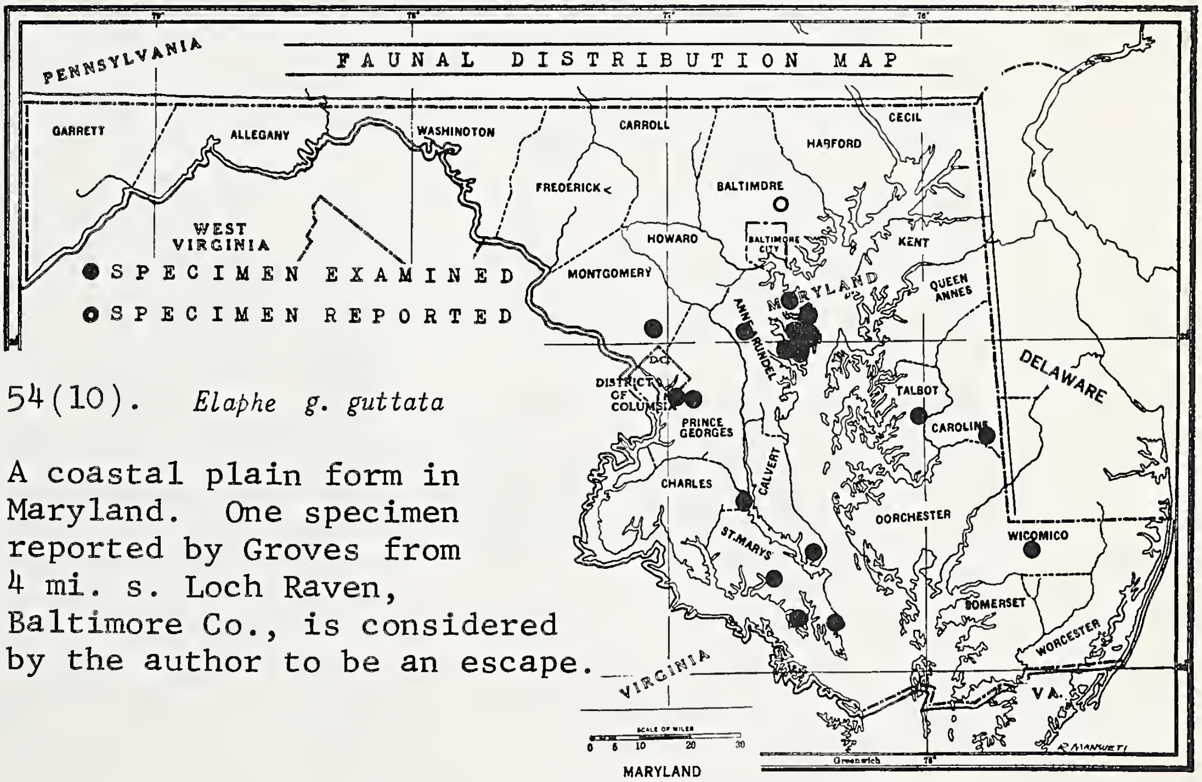
52(8). *Coluber c. constrictor*

State wide in distribution.



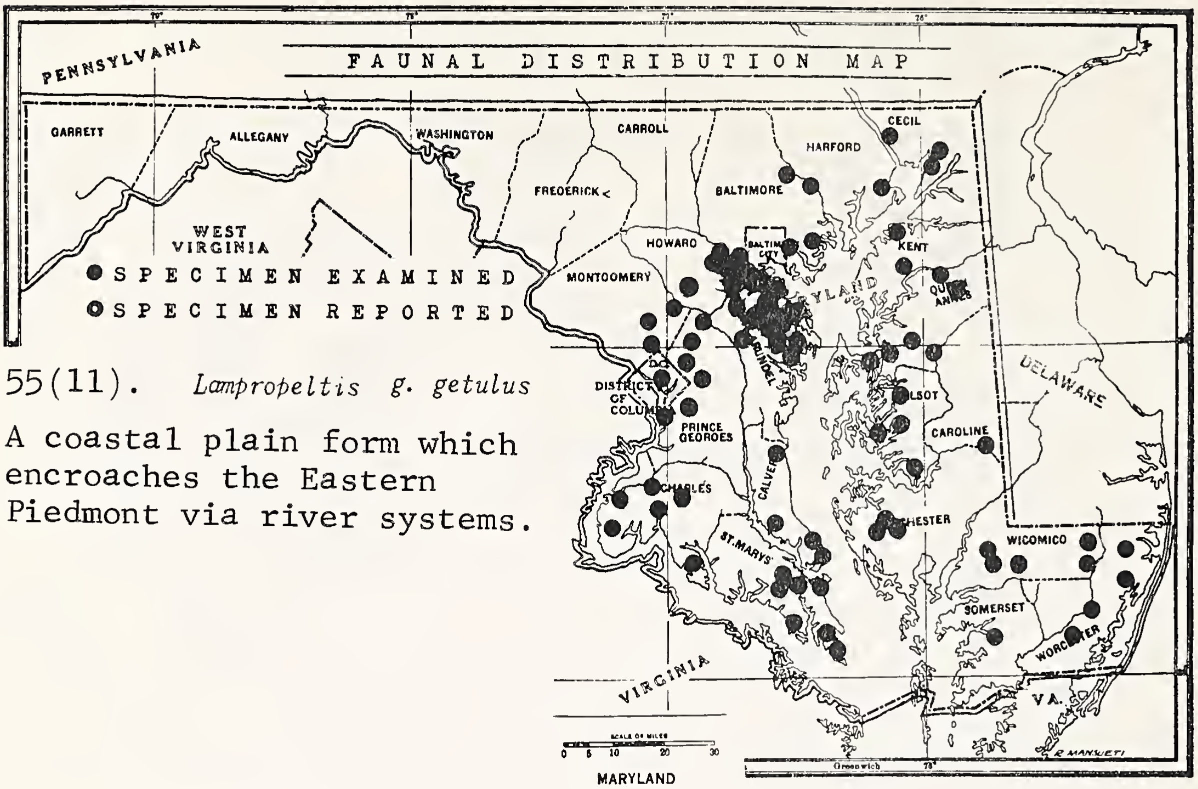
53(9). *Elaphe o. obsoleta*

State wide in distribution.



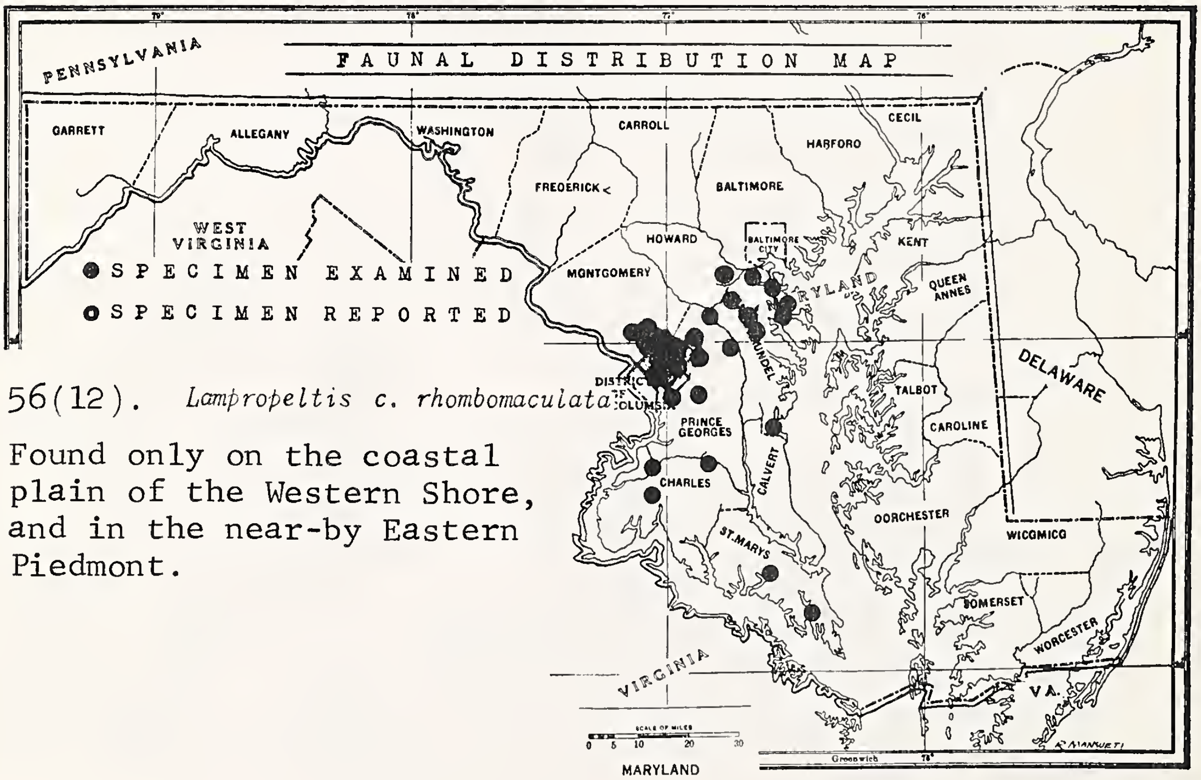
54(10). *Elaphe g. guttata*

A coastal plain form in Maryland. One specimen reported by Groves from 4 mi. s. Loch Raven, Baltimore Co., is considered by the author to be an escape.



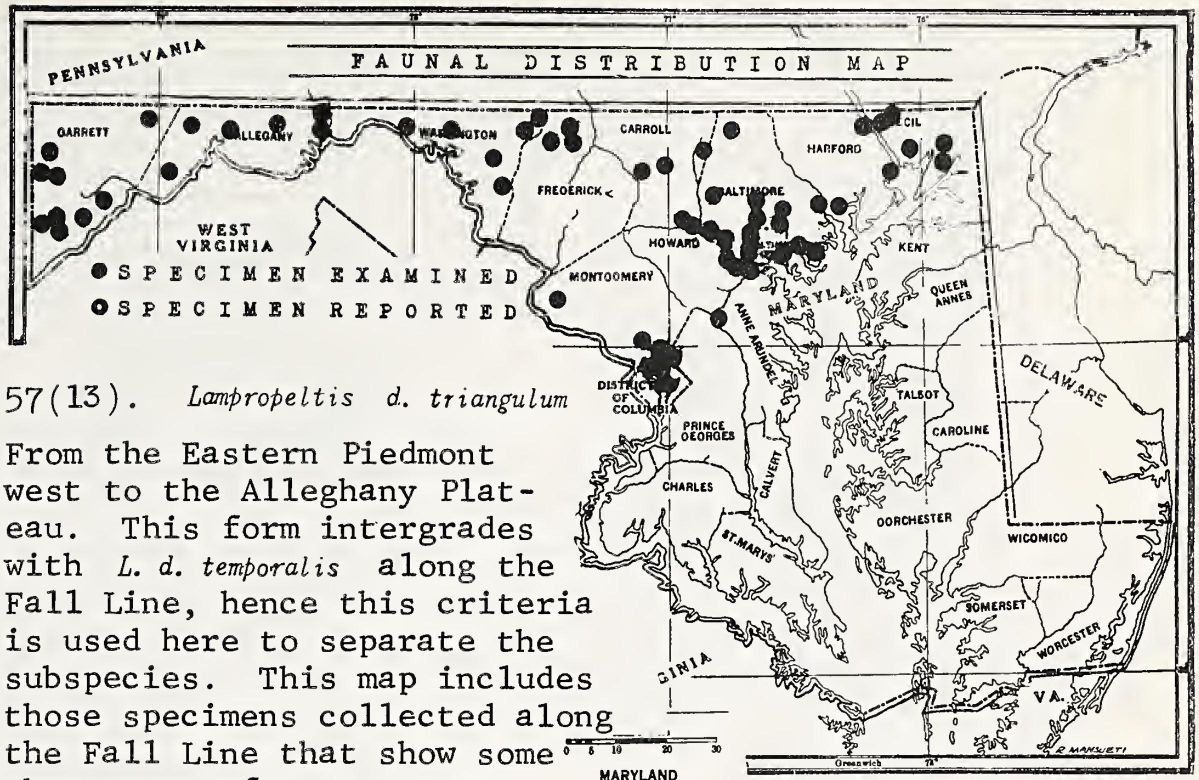
55(11). *Lampropeltis g. getulus*

A coastal plain form which encroaches the Eastern Piedmont via river systems.



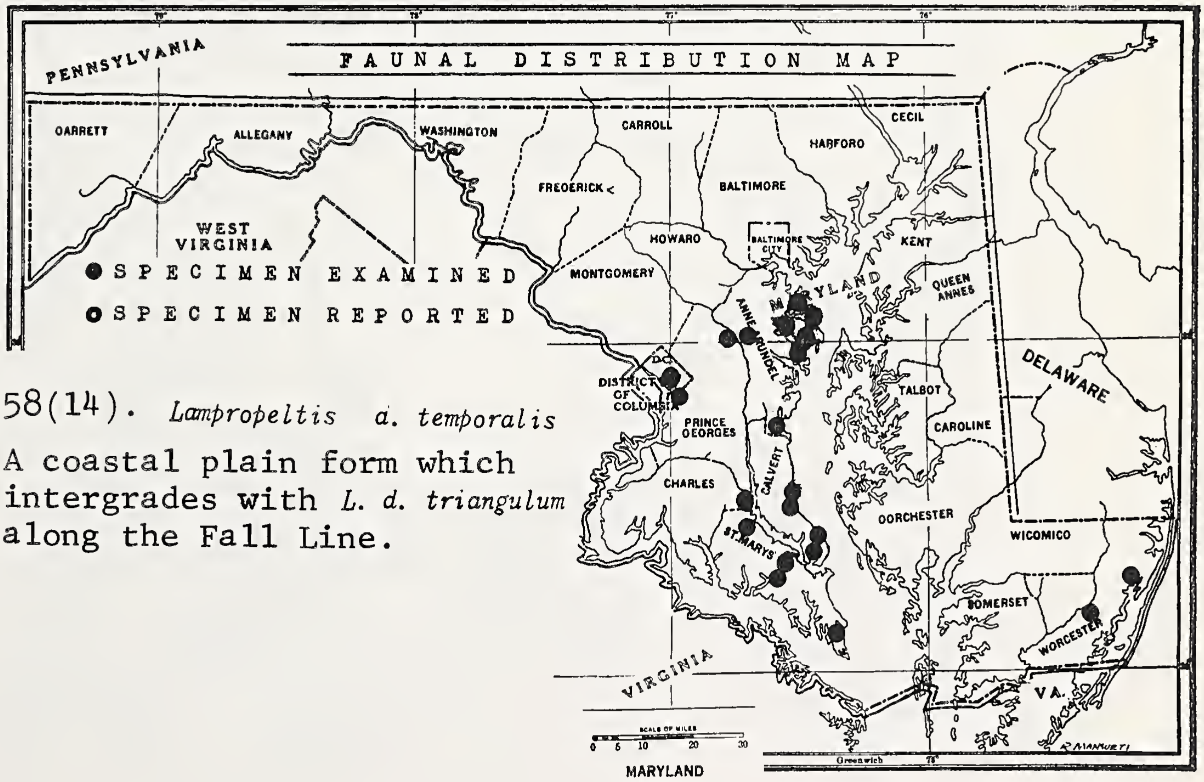
56(12). *Lampropeltis c. rhombomaculata*

Found only on the coastal plain of the Western Shore, and in the near-by Eastern Piedmont.



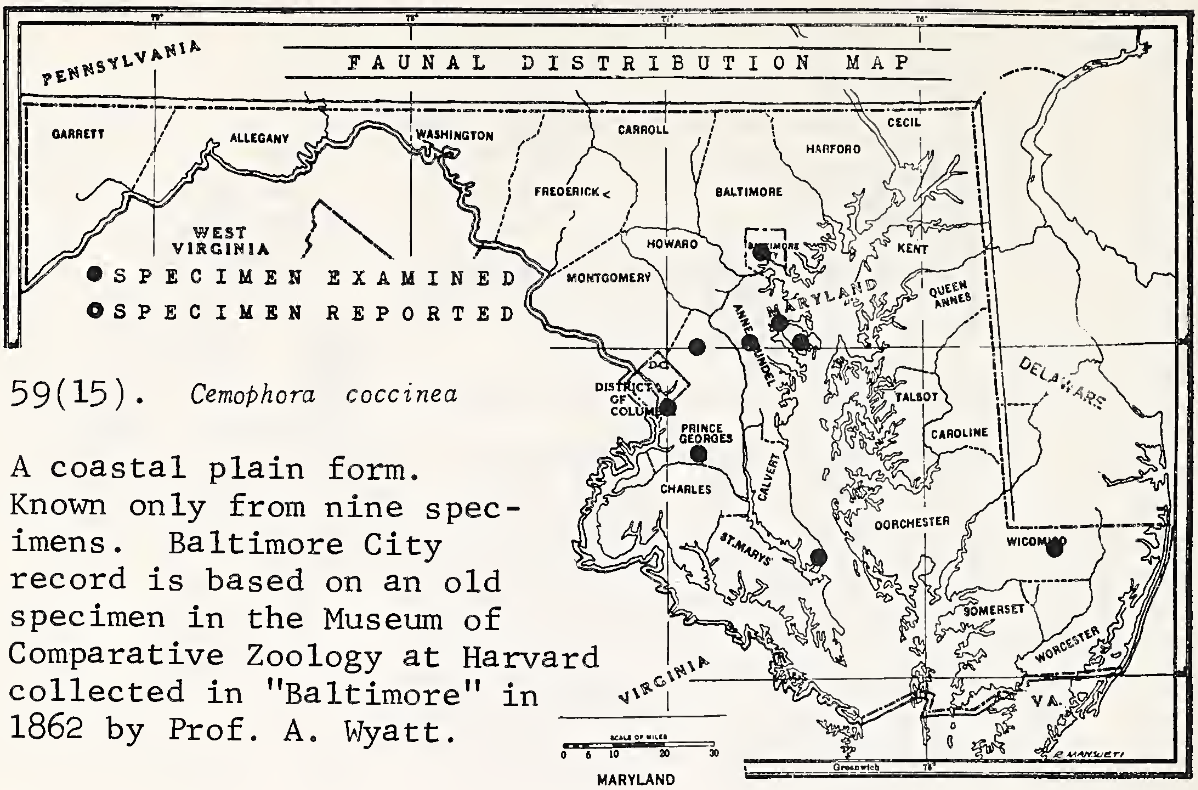
57(13). *Lampropeltis d. triangulum*

From the Eastern Piedmont west to the Alleghany Plateau. This form intergrades with *L. d. temporalis* along the Fall Line, hence this criteria is used here to separate the subspecies. This map includes those specimens collected along the Fall Line that show some characters of *L. d. temporalis* .



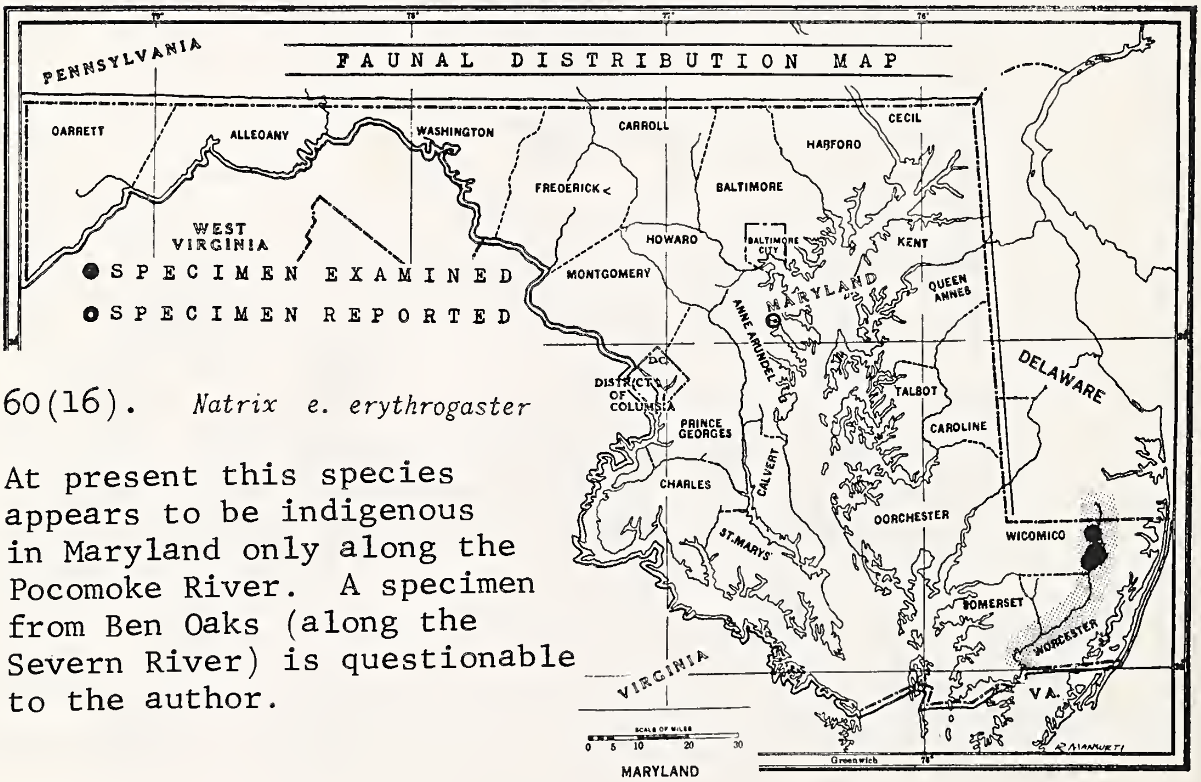
58(14). *Lampropeltis d. temporalis*

A coastal plain form which intergrades with *L. d. triangulum* along the Fall Line.



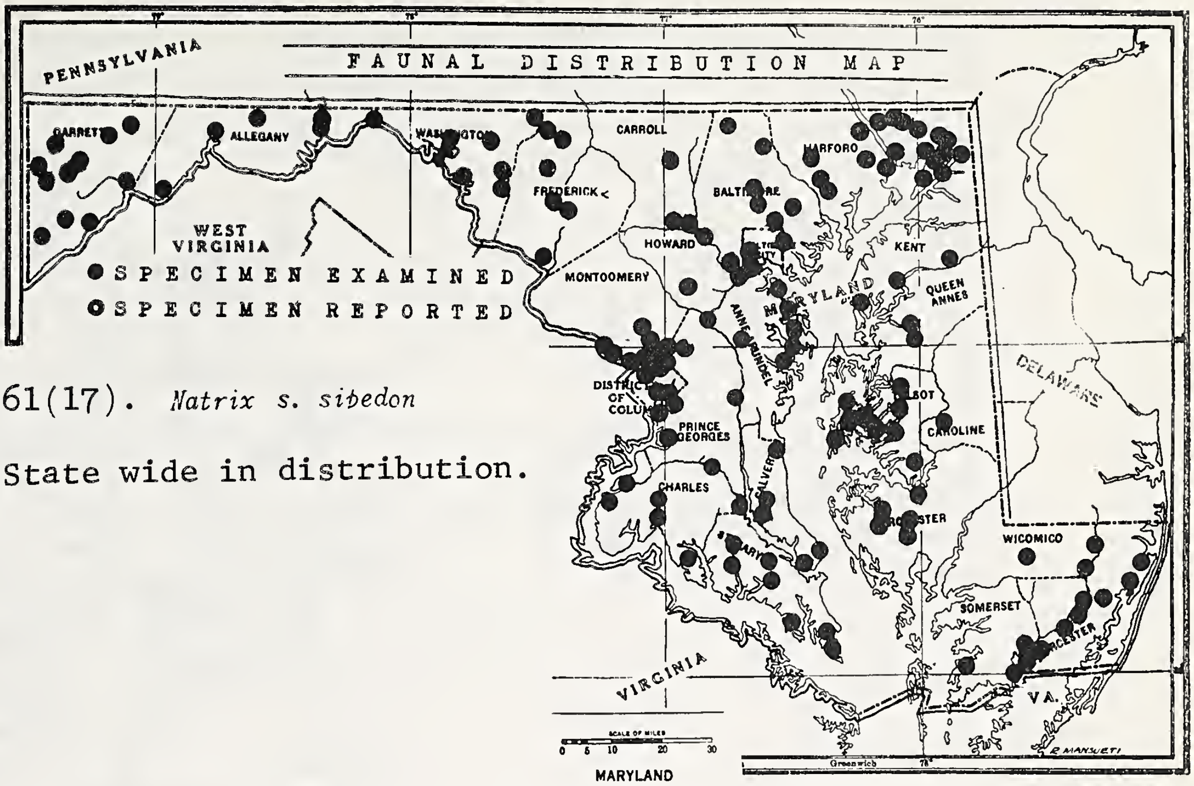
59(15). *Cemophora coccinea*

A coastal plain form. Known only from nine specimens. Baltimore City record is based on an old specimen in the Museum of Comparative Zoology at Harvard collected in "Baltimore" in 1862 by Prof. A. Wyatt.



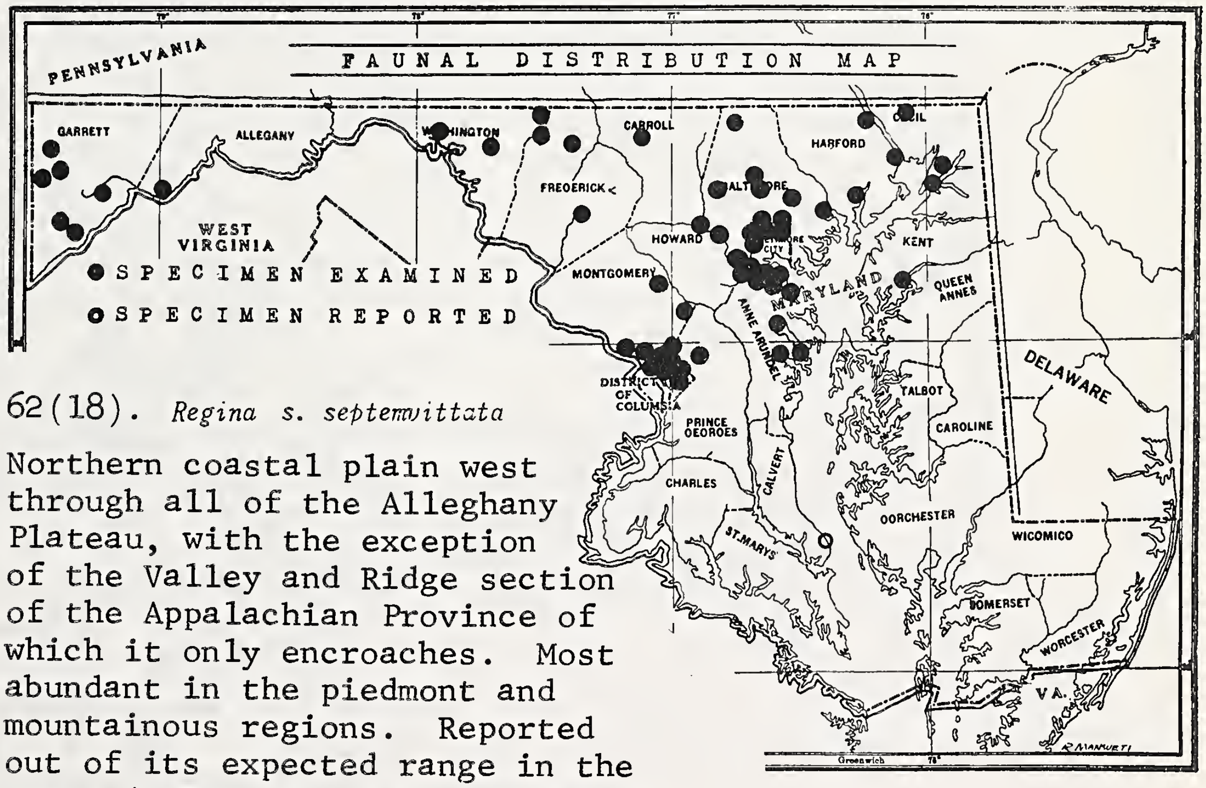
60(16). *Natrix e. erythrogaster*

At present this species appears to be indigenous in Maryland only along the Pocomoke River. A specimen from Ben Oaks (along the Severn River) is questionable to the author.



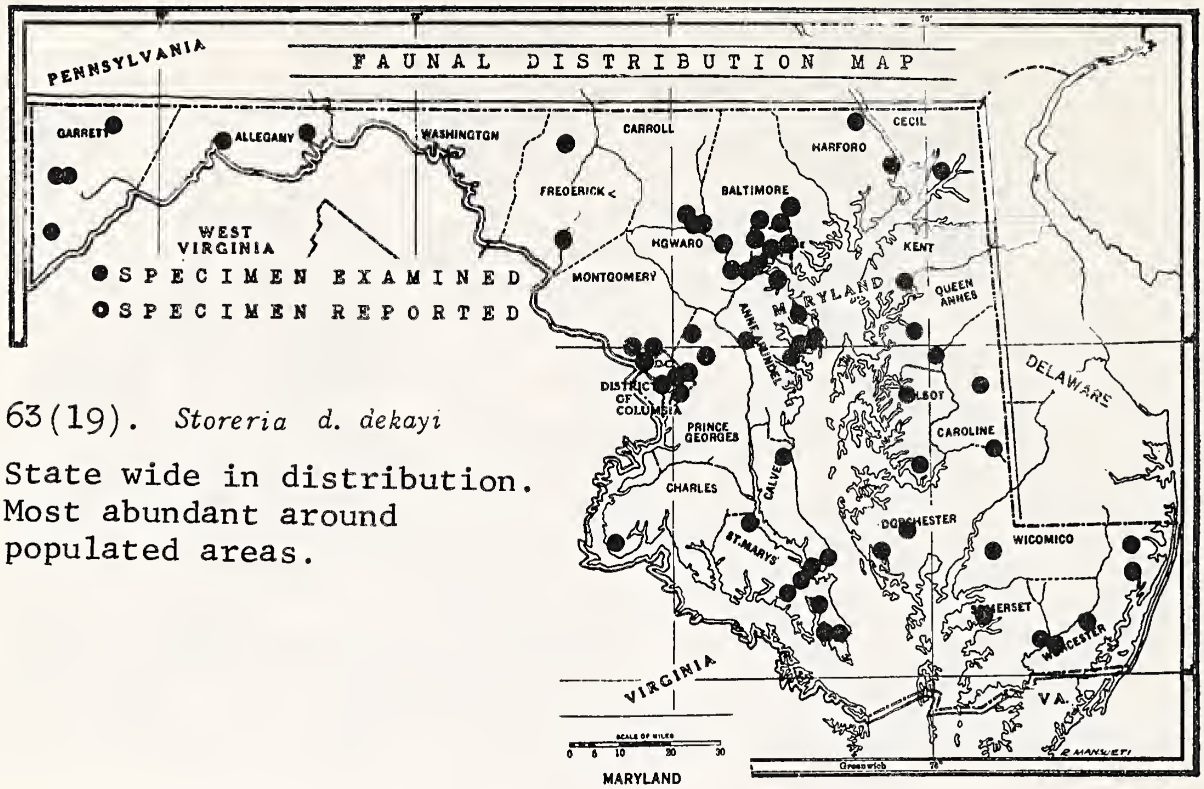
61(17). *Natrix s. sipedon*

State wide in distribution.



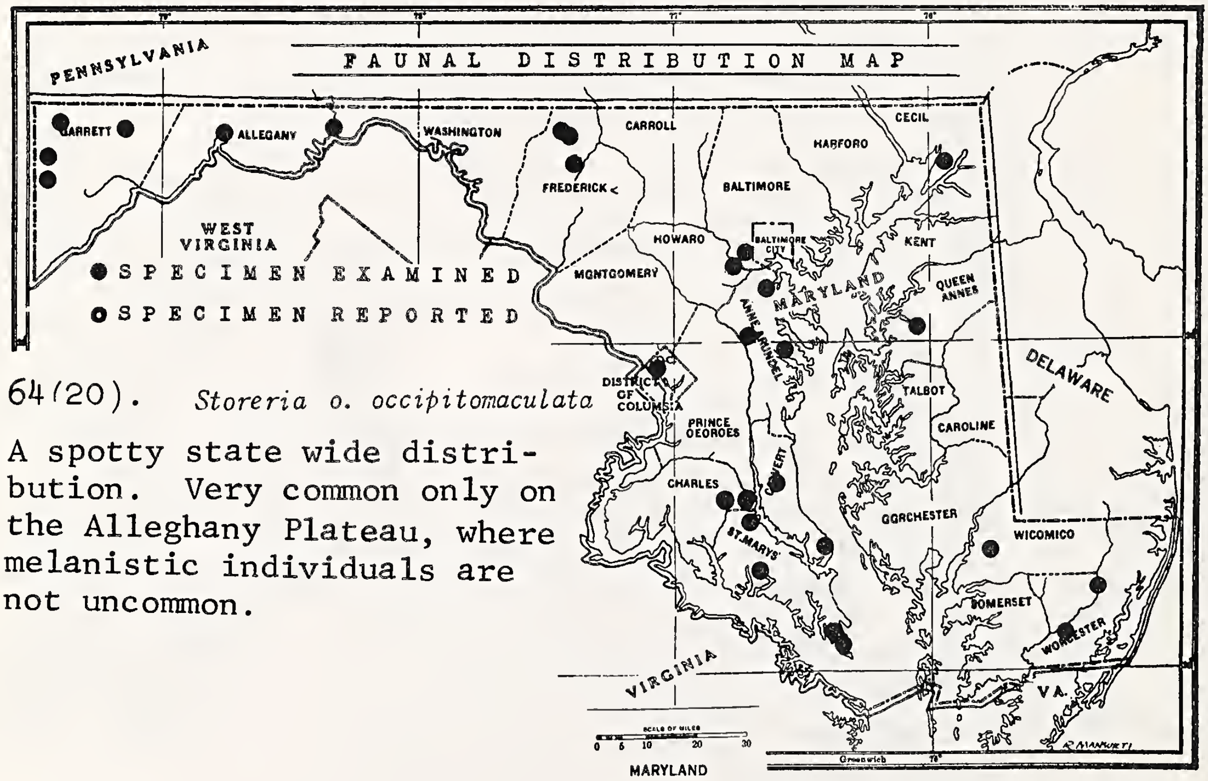
62(18). *Regina s. septemvittata*

Northern coastal plain west through all of the Alleghany Plateau, with the exception of the Valley and Ridge section of the Appalachian Province of which it only encroaches. Most abundant in the piedmont and mountainous regions. Reported out of its expected range in the state (Calvert Co.) by Hardy and Mansuetti (1962). Specimens unavailable.



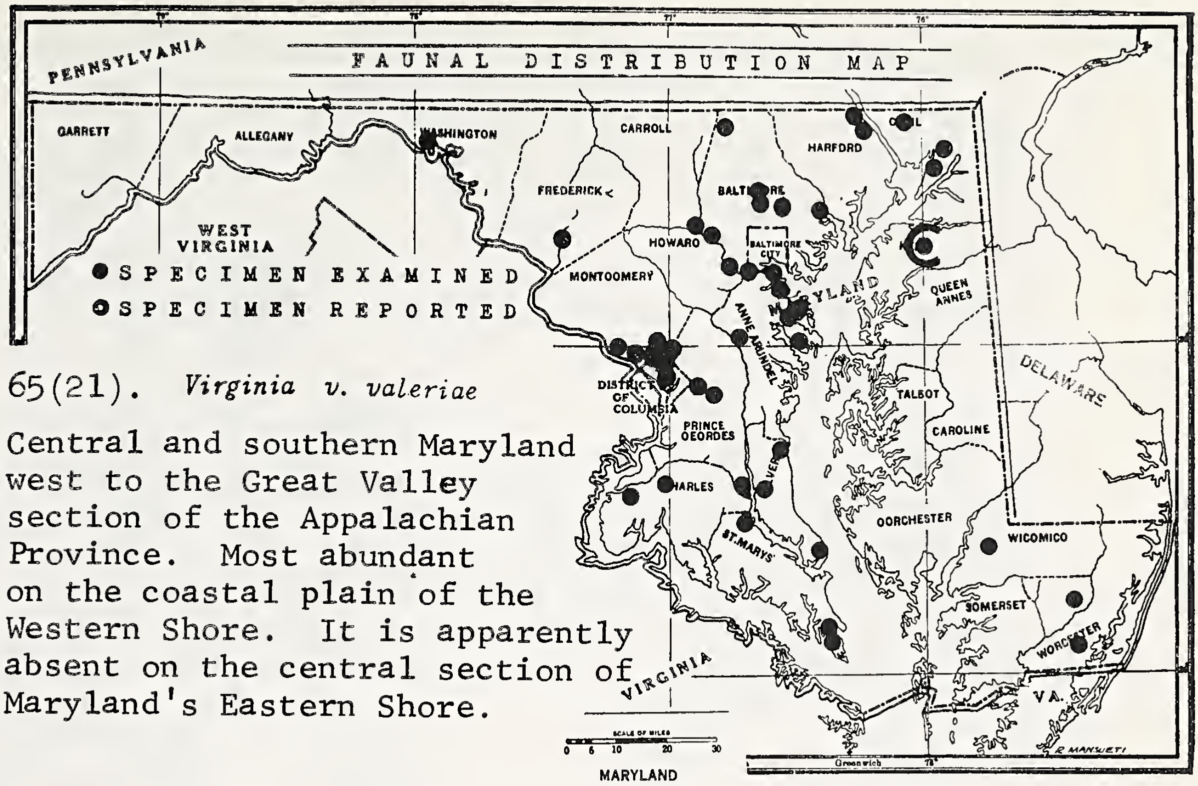
63(19). *Storeria d. dekayi*

State wide in distribution. Most abundant around populated areas.



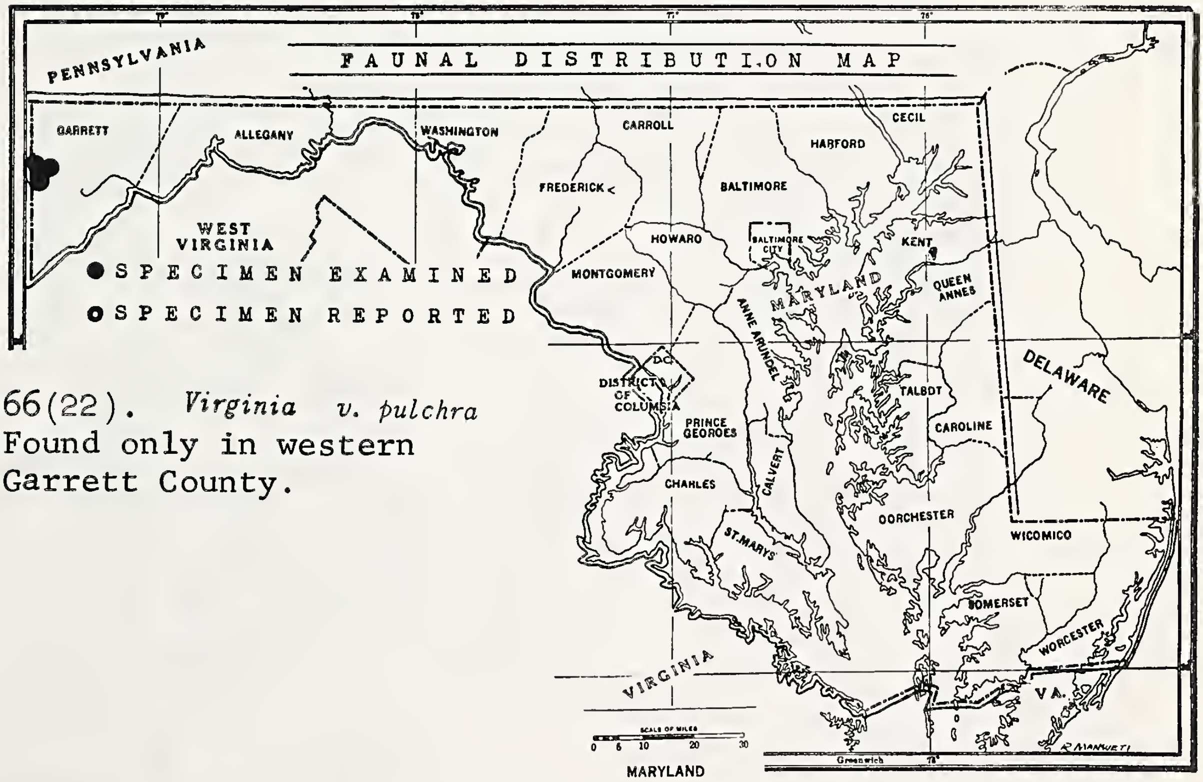
64(20). *Storeria o. occipitomaculata*

A spotty state wide distribution. Very common only on the Alleghany Plateau, where melanistic individuals are not uncommon.

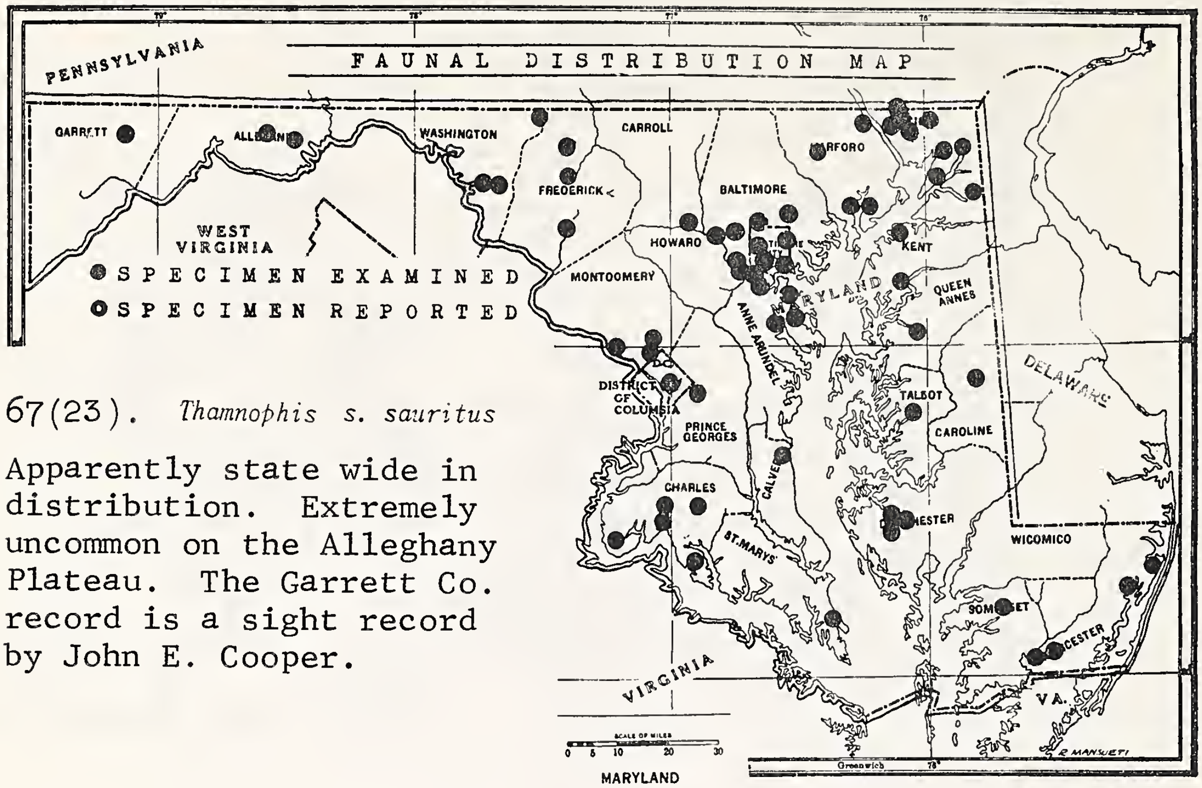


65(21). *Virginia v. valeriae*

Central and southern Maryland west to the Great Valley section of the Appalachian Province. Most abundant on the coastal plain of the Western Shore. It is apparently absent on the central section of Maryland's Eastern Shore.

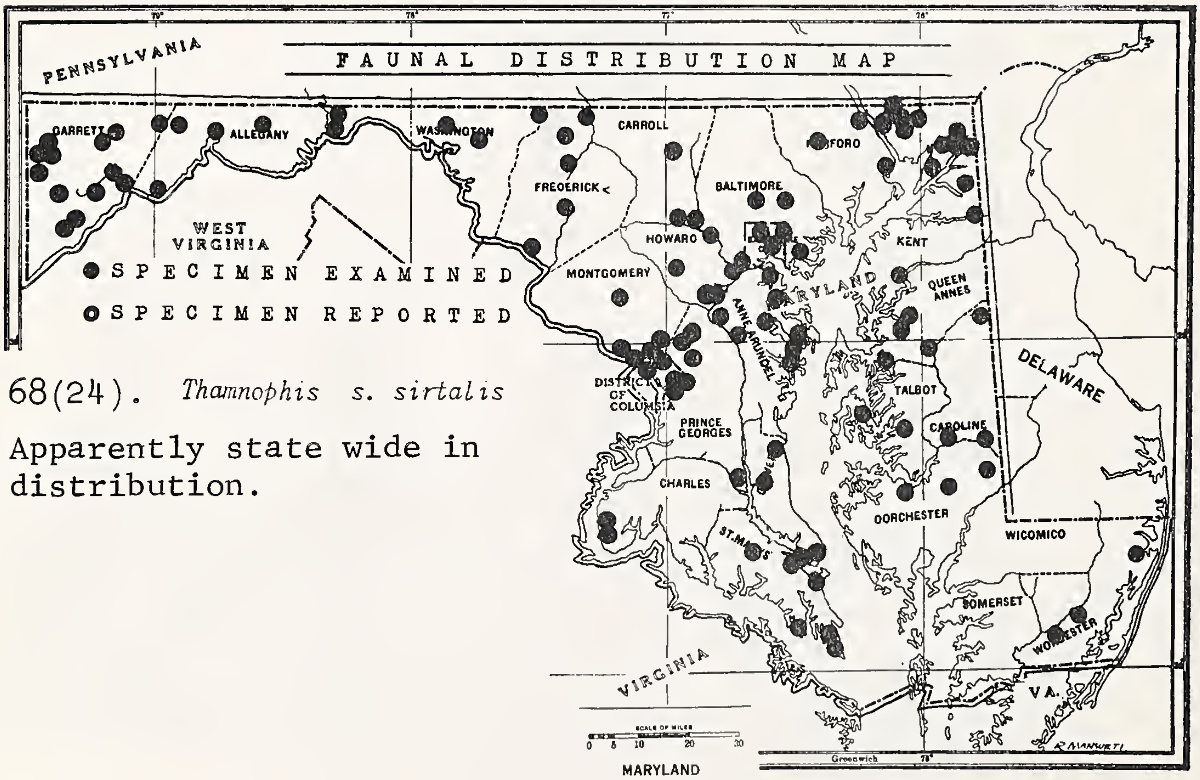


66(22). *Virginia v. pulchra*
Found only in western Garrett County.



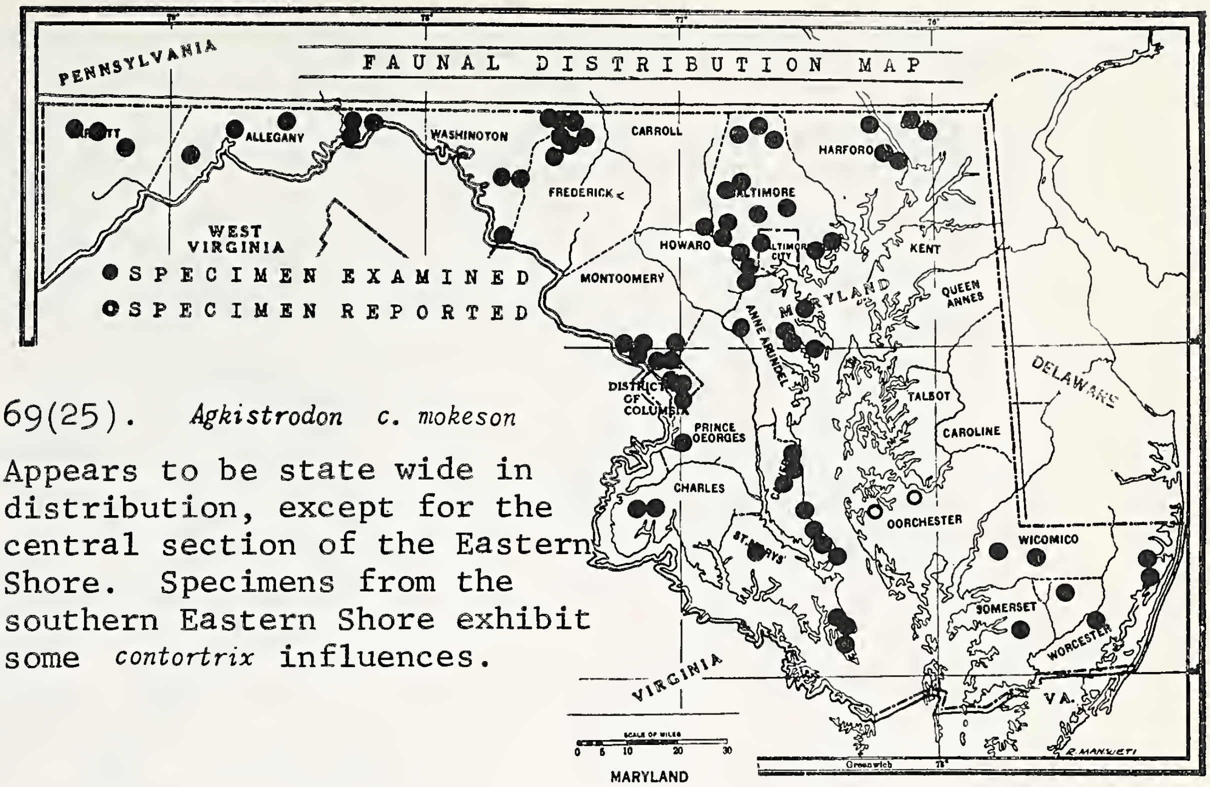
67(23). *Thamnophis s. sauritus*

Apparently state wide in distribution. Extremely uncommon on the Alleghany Plateau. The Garrett Co. record is a sight record by John E. Cooper.



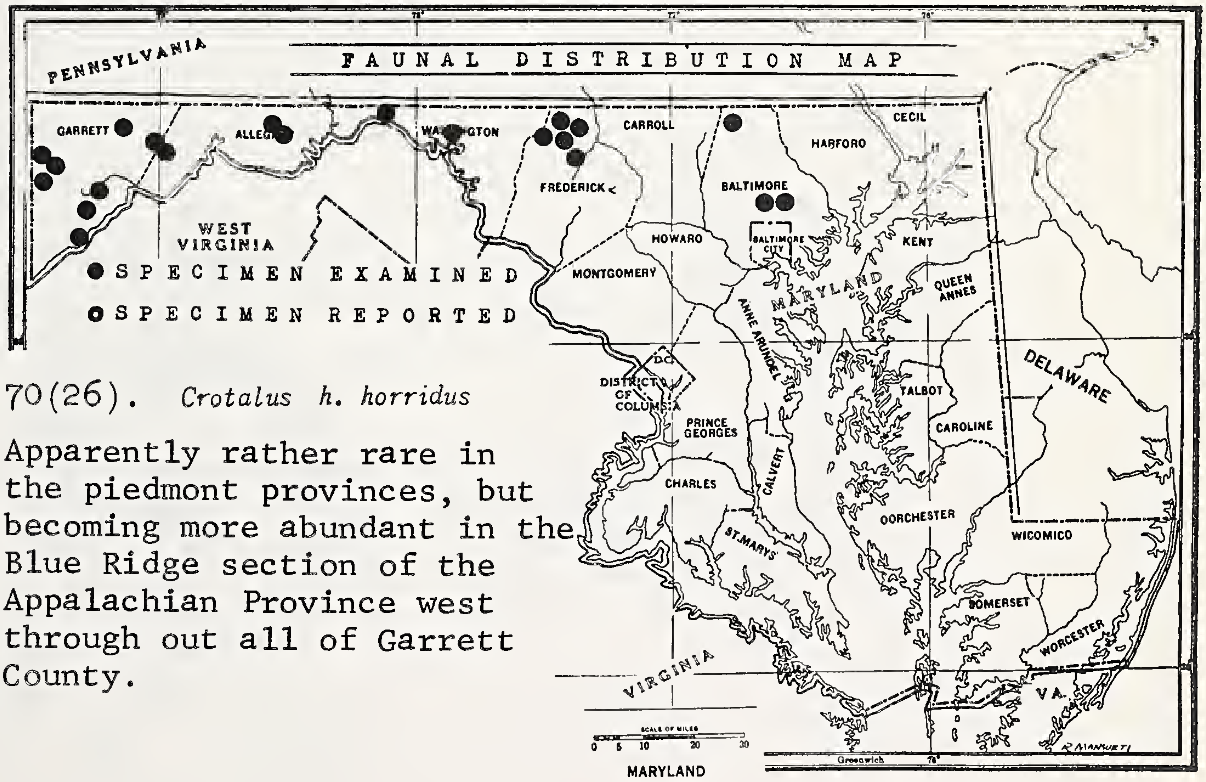
68(24). *Thamnophis s. sirtalis*

Apparently state wide in distribution.



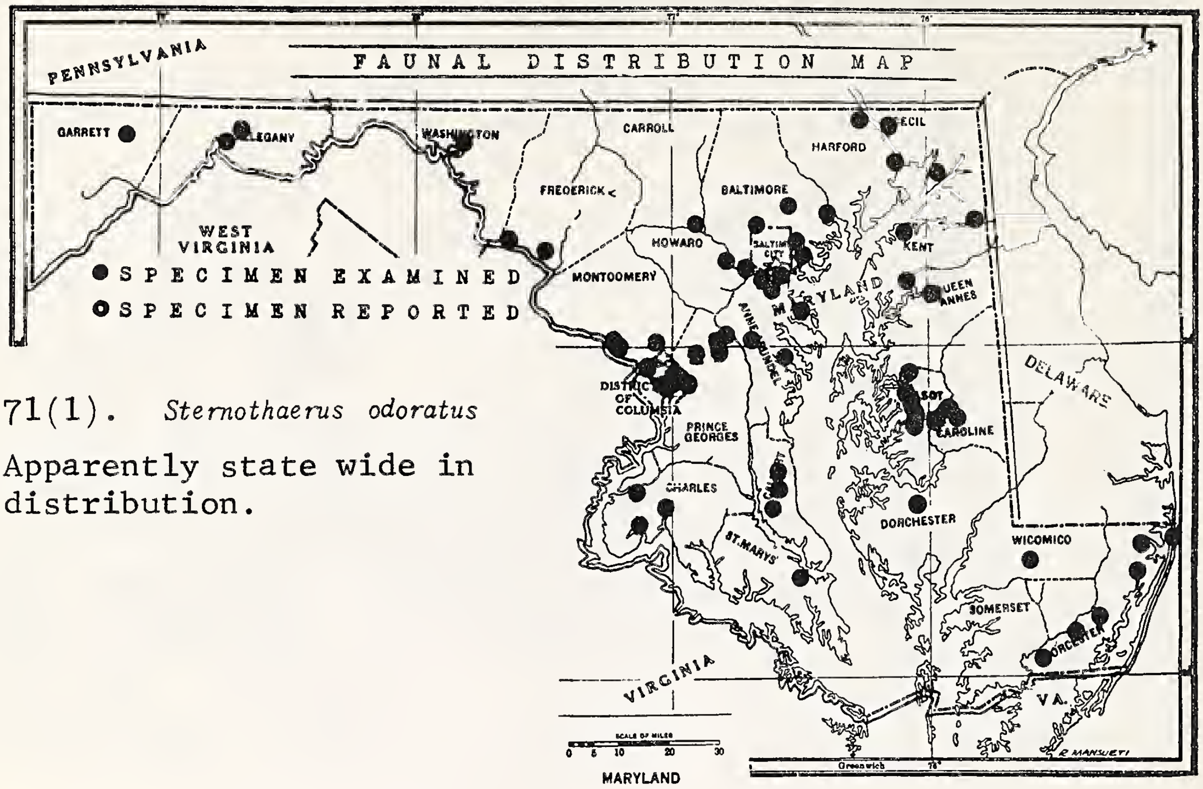
69(25). *Agkistrodon c. mokeson*

Appears to be state wide in distribution, except for the central section of the Eastern Shore. Specimens from the southern Eastern Shore exhibit some *contortrix* influences.



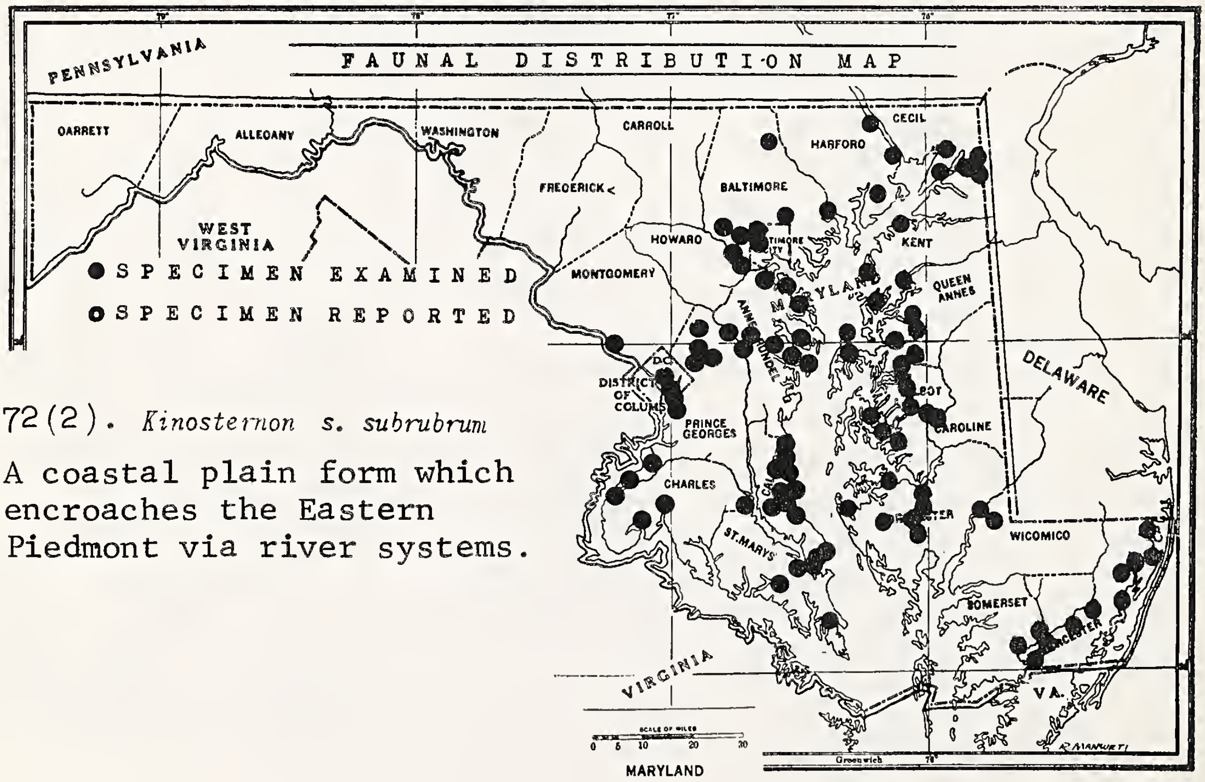
70(26). *Crotalus h. horridus*

Apparently rather rare in the piedmont provinces, but becoming more abundant in the Blue Ridge section of the Appalachian Province west through out all of Garrett County.



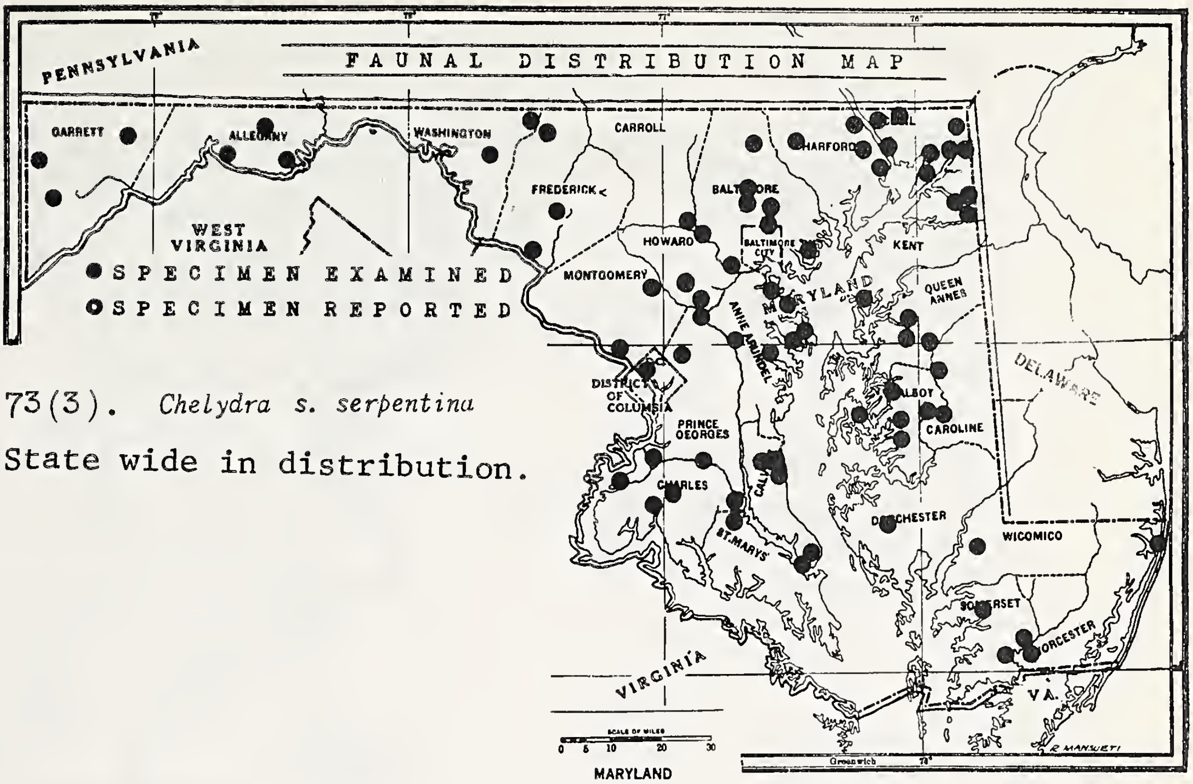
71(1). *Sternothaerus odoratus*

Apparently state wide in distribution.



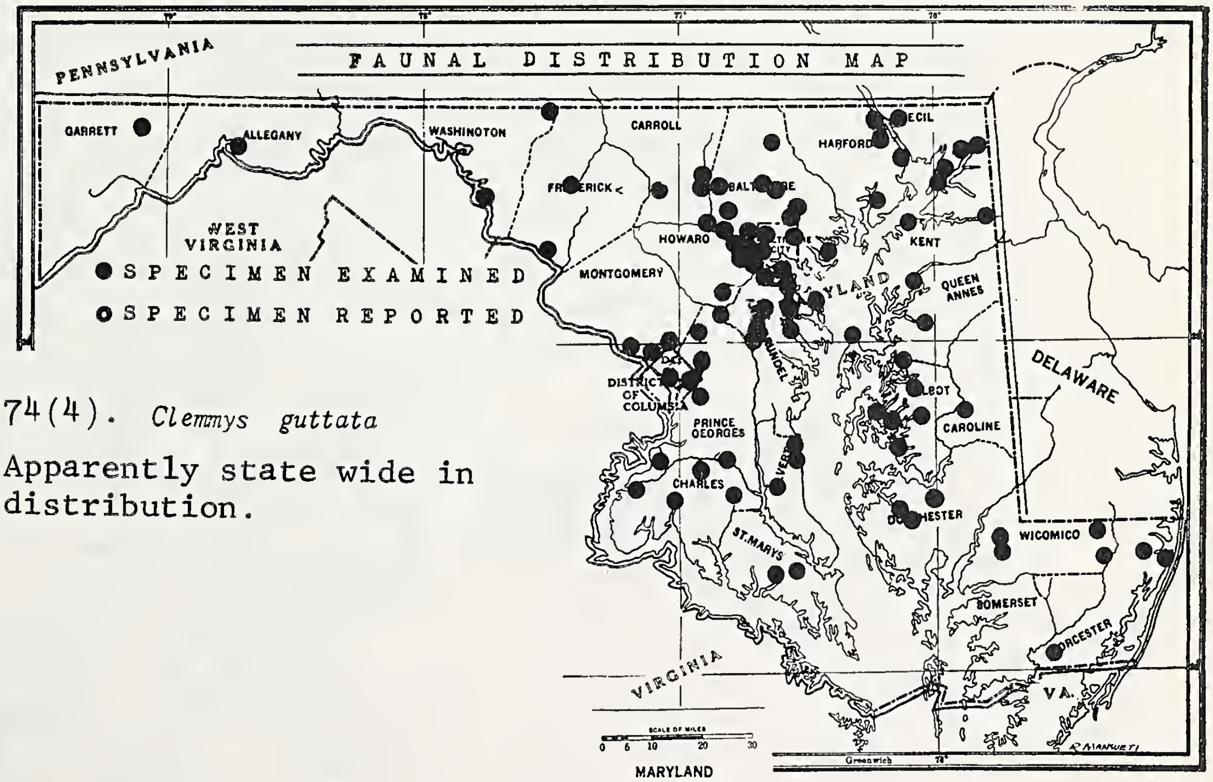
72(2). *Kinosternon s. subrubrum*

A coastal plain form which encroaches the Eastern Piedmont via river systems.



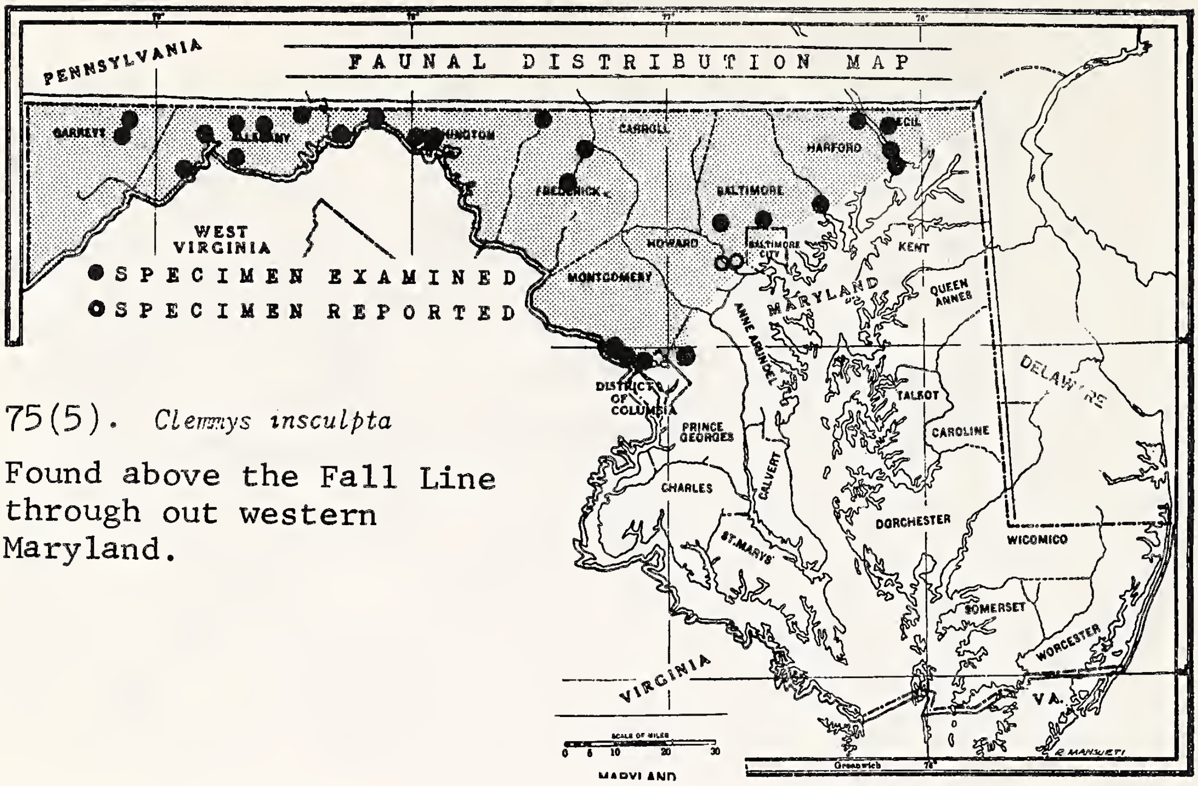
73(3). *Chelydra s. serpentina*

State wide in distribution.



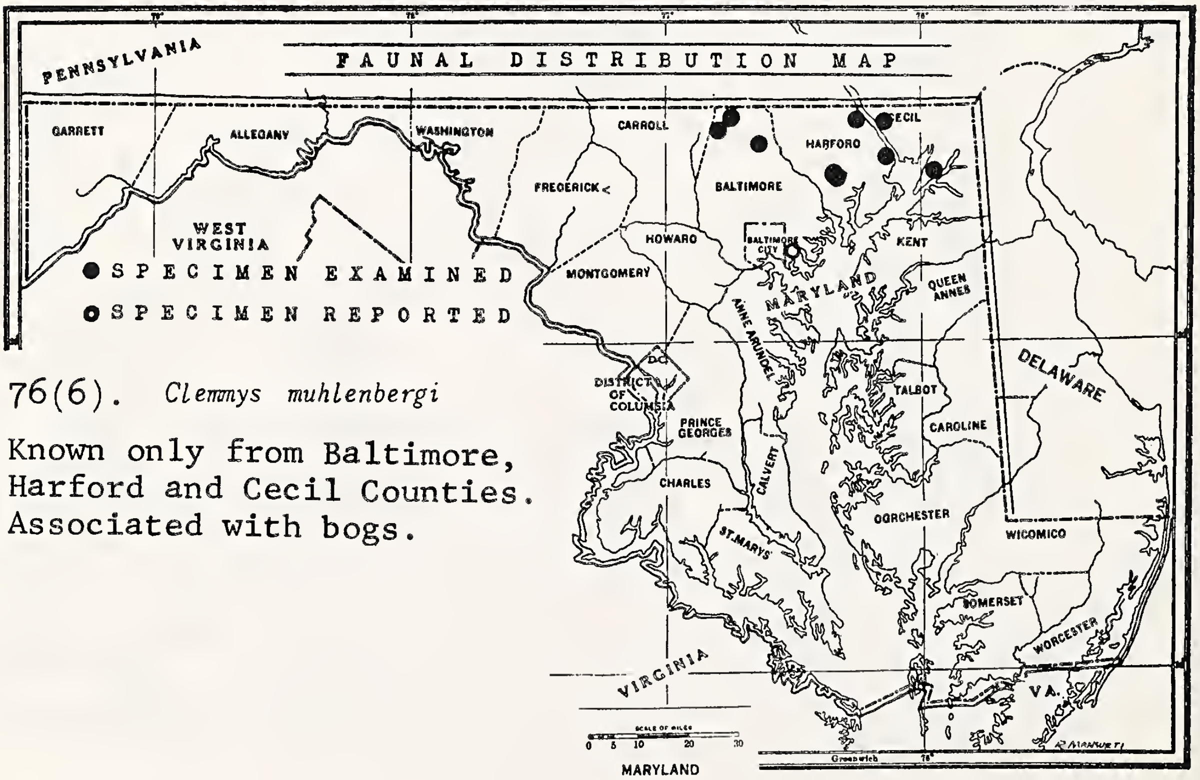
74(4). *Clemmys guttata*

Apparently state wide in distribution.



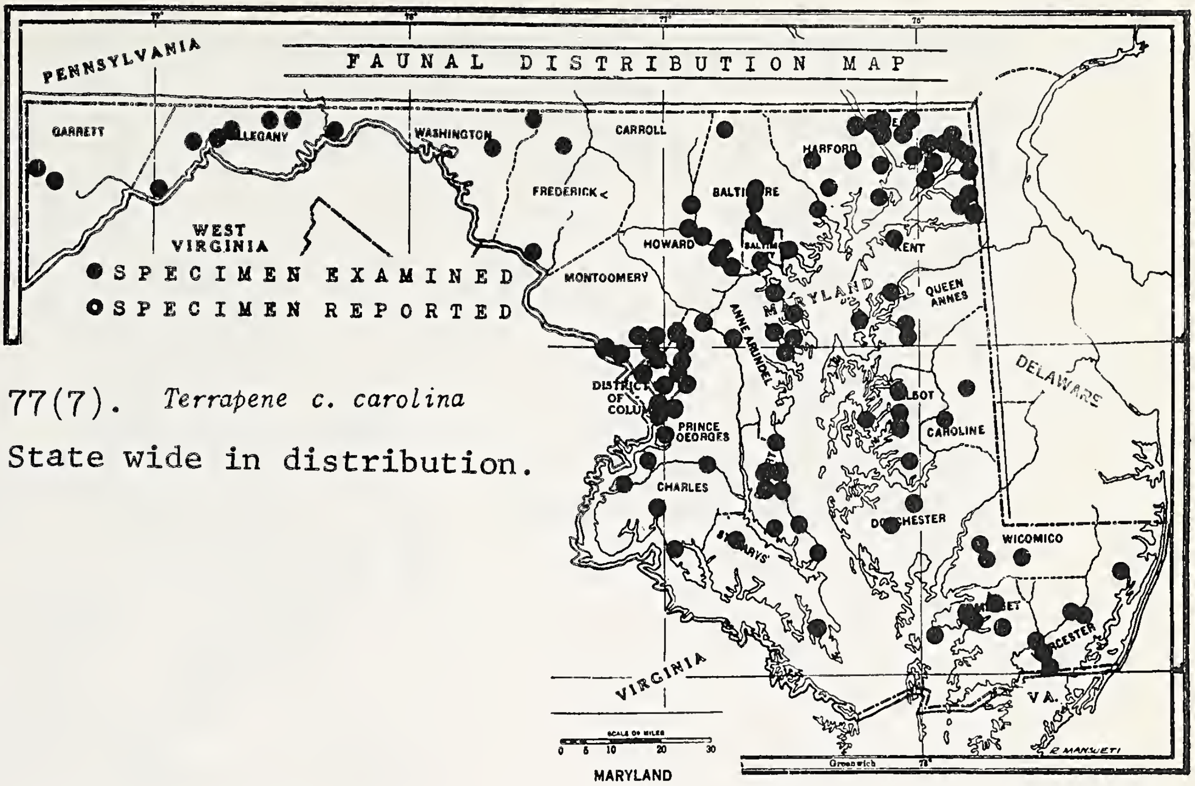
75(5). *Clemmys insculpta*

Found above the Fall Line through out western Maryland.



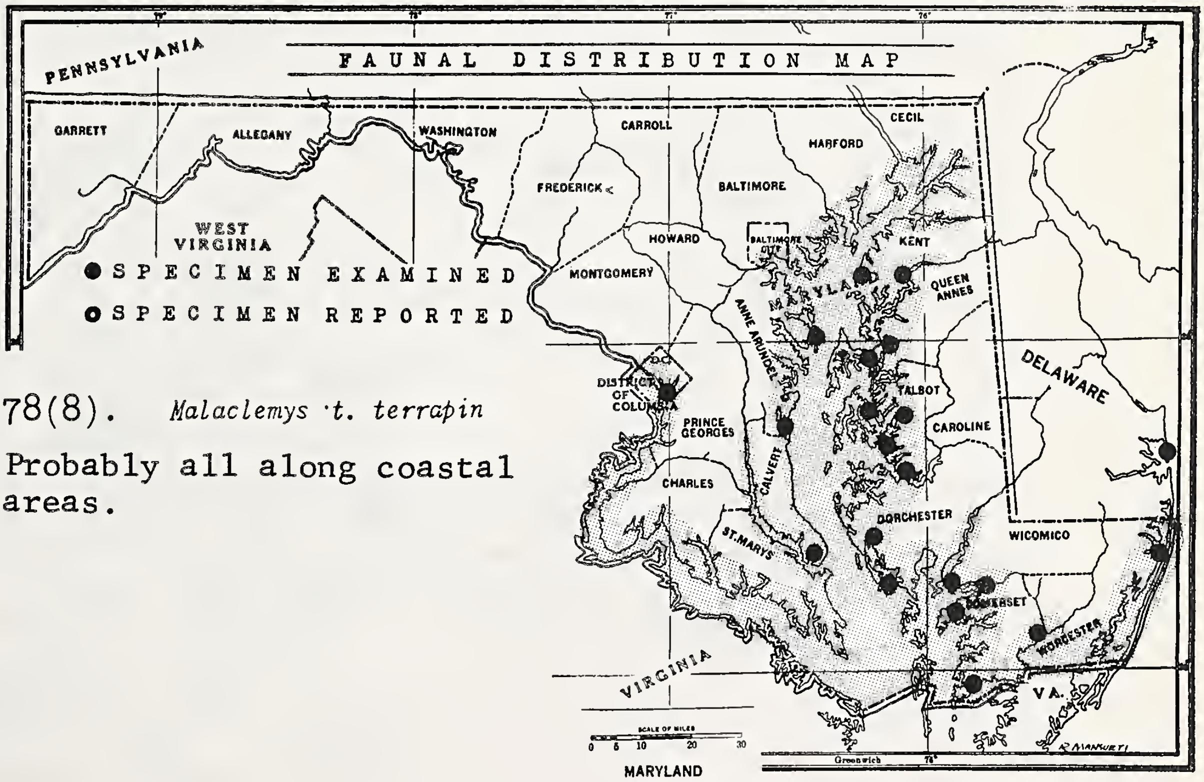
76(6). *Clemmys muhlenbergi*

Known only from Baltimore, Harford and Cecil Counties. Associated with bogs.



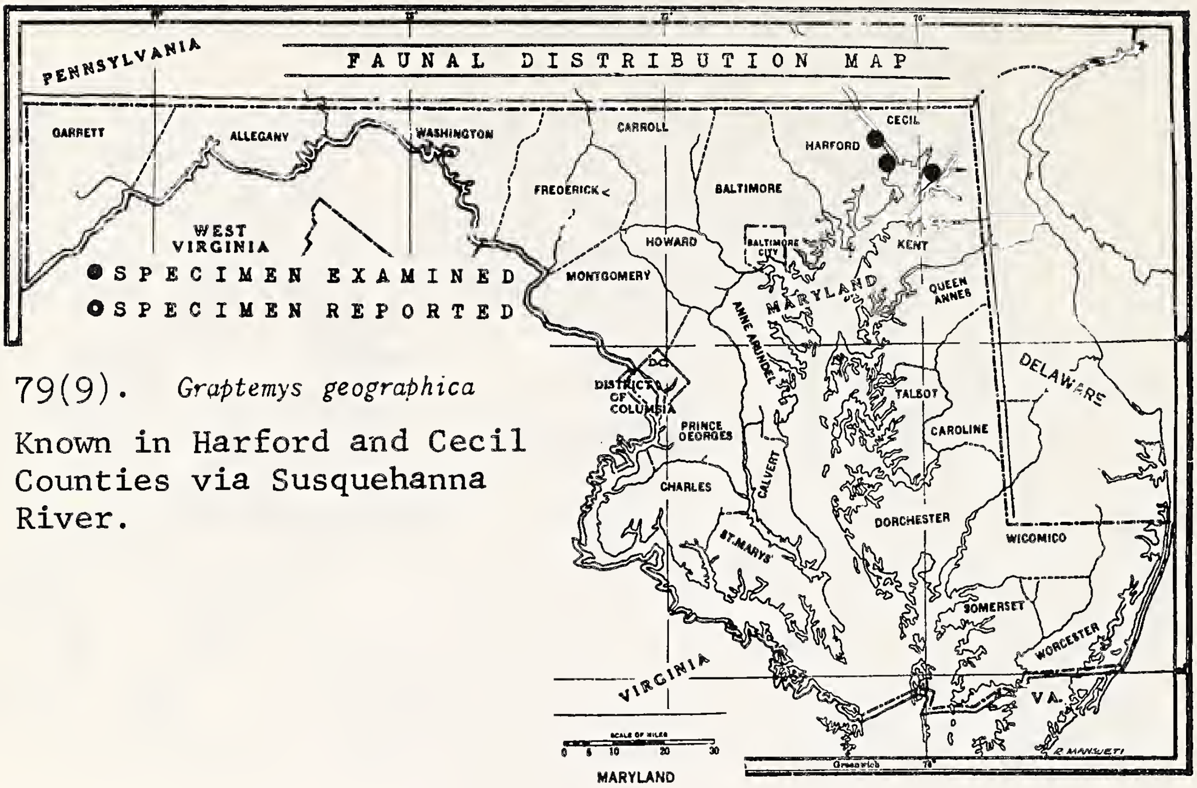
77(7). *Terrapene c. carolina*

State wide in distribution.



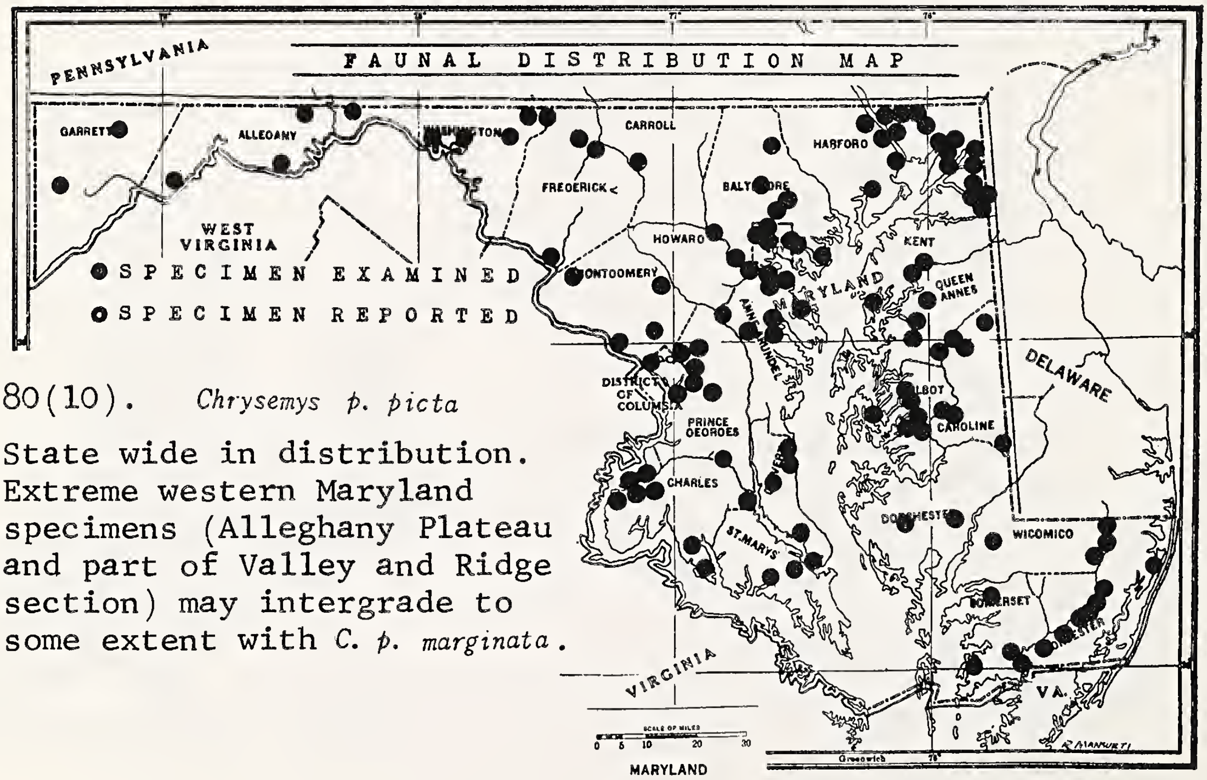
78(8). *Malaclemys t. terrapin*

Probably all along coastal areas.



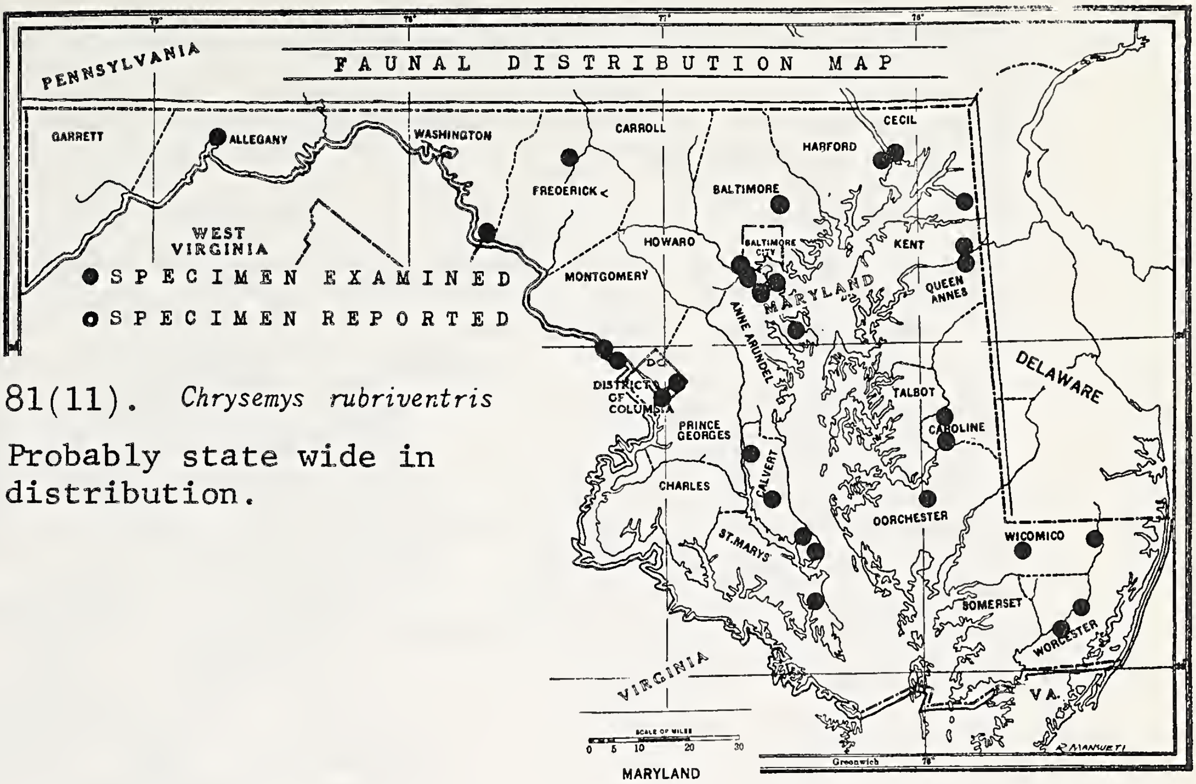
79(9). *Graptemys geographica*

Known in Harford and Cecil Counties via Susquehanna River.



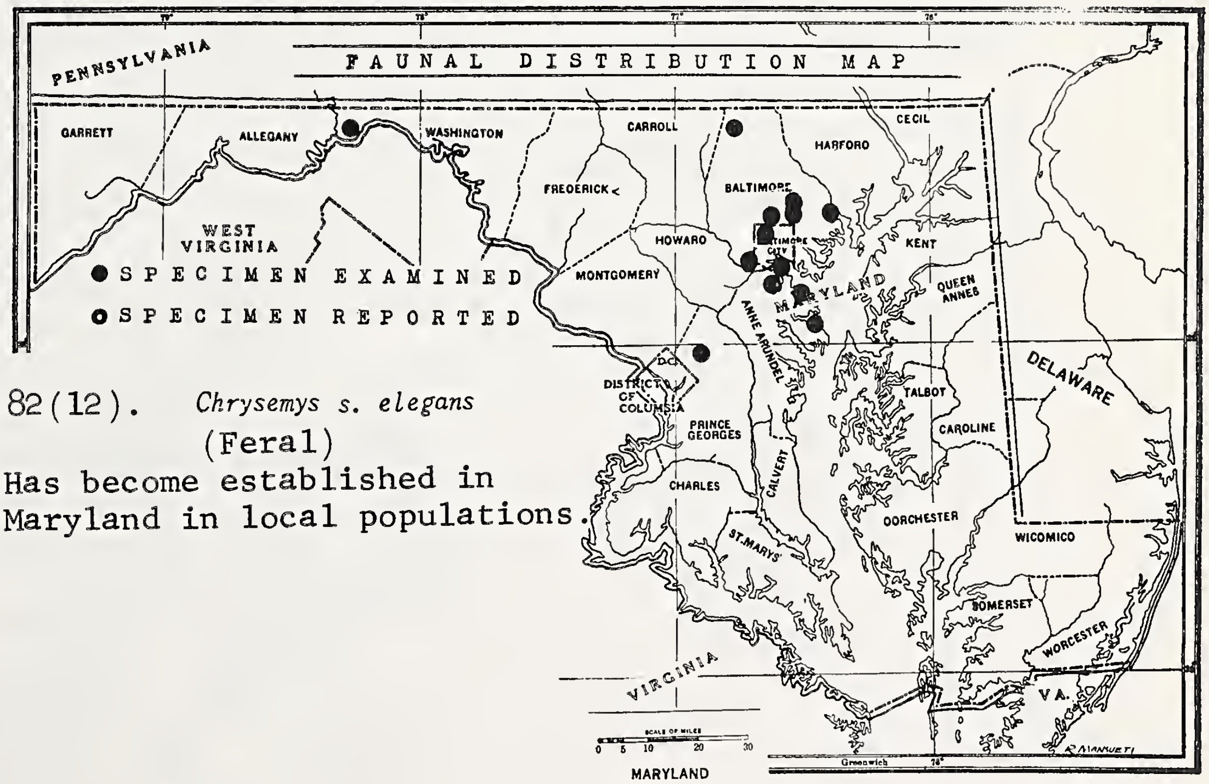
80(10). *Chrysemys p. picta*

State wide in distribution. Extreme western Maryland specimens (Alleghany Plateau and part of Valley and Ridge section) may intergrade to some extent with *C. p. marginata*.



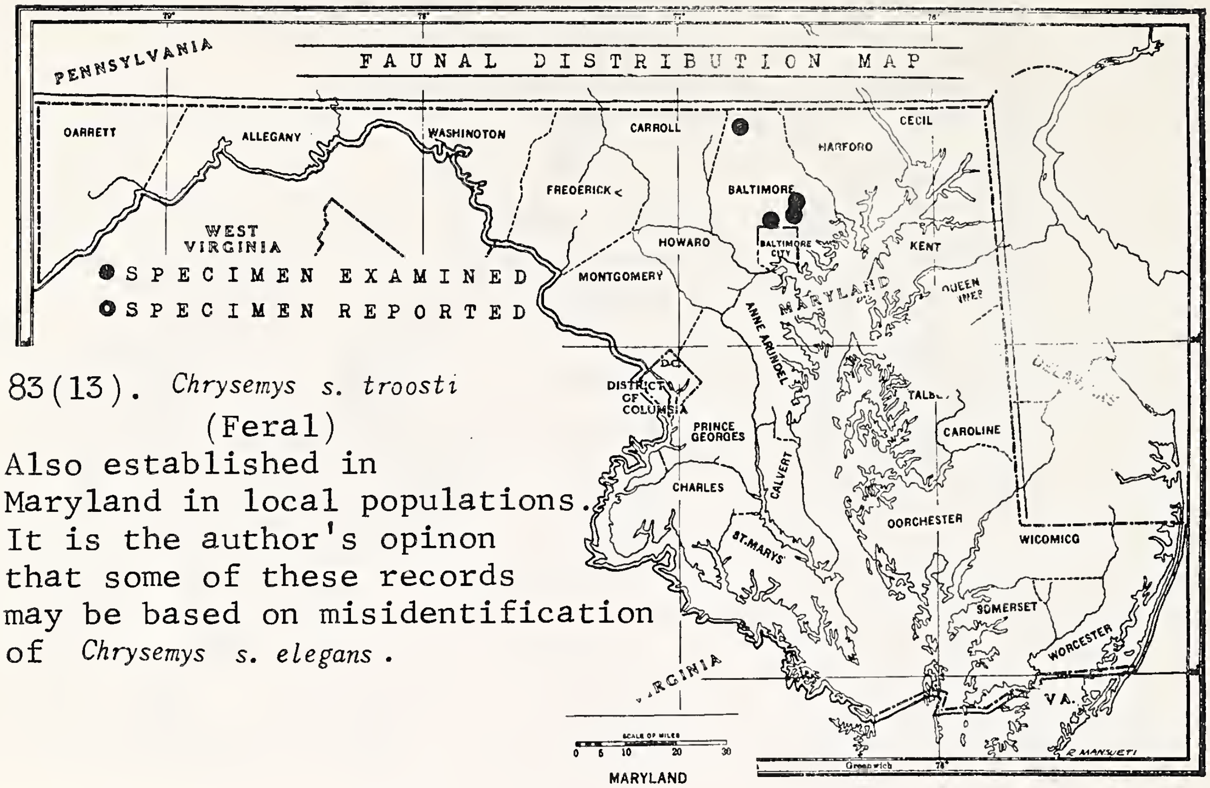
81(11). *Chrysemys rubriventris*

Probably state wide in distribution.

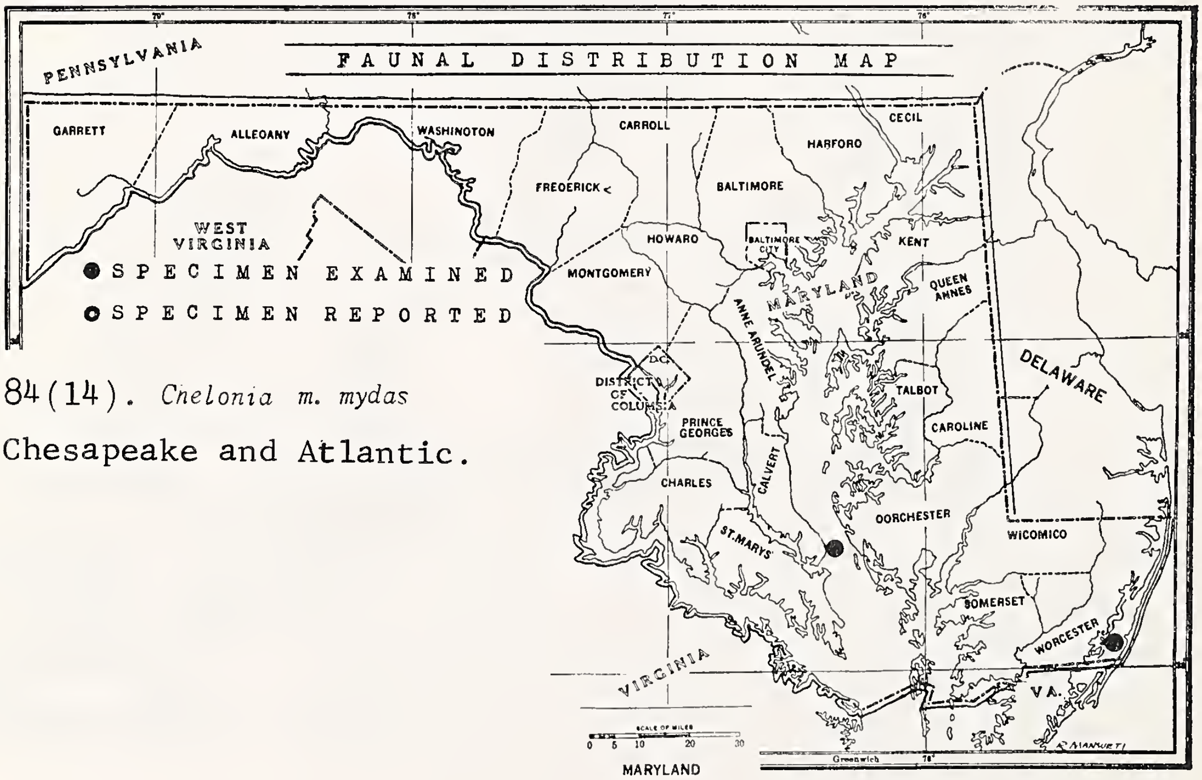


82(12). *Chrysemys s. elegans*
(Feral)

Has become established in Maryland in local populations.

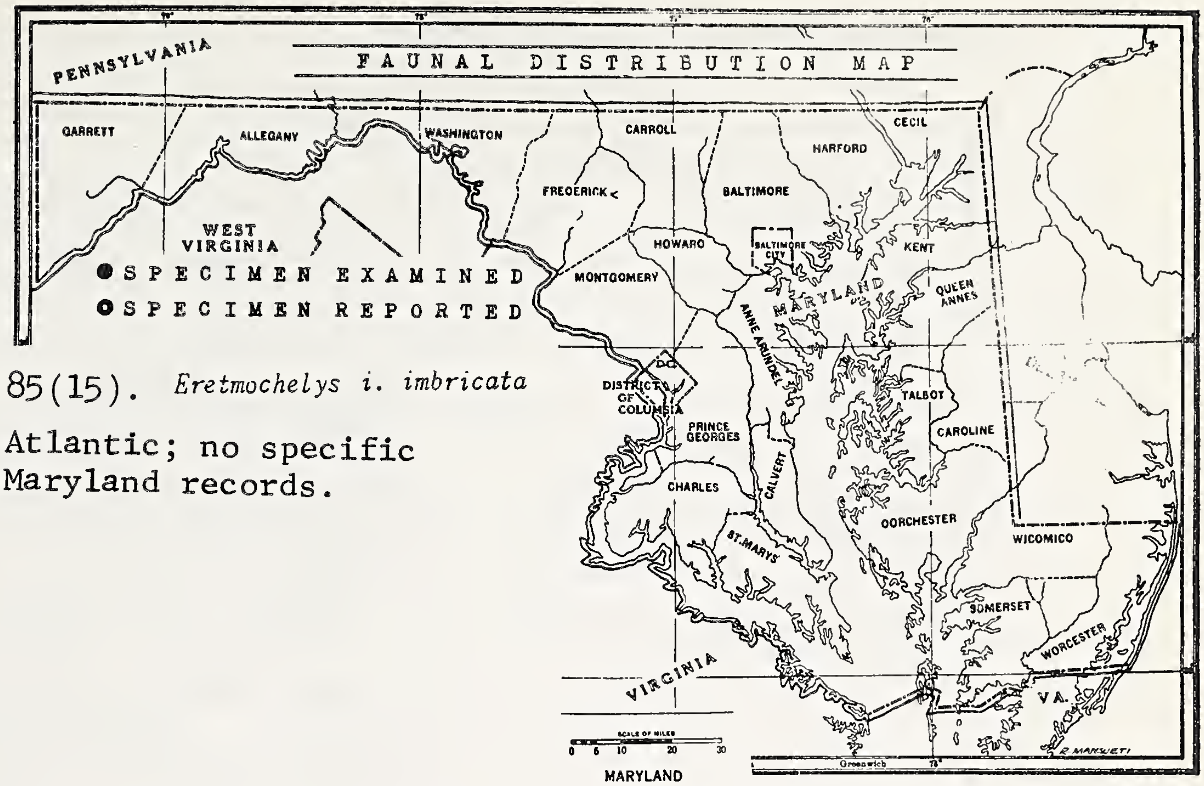


83(13). *Chrysemys s. troosti*
(Feral)
Also established in Maryland in local populations. It is the author's opinon that some of these records may be based on misidentification of *Chrysemys s. elegans*.



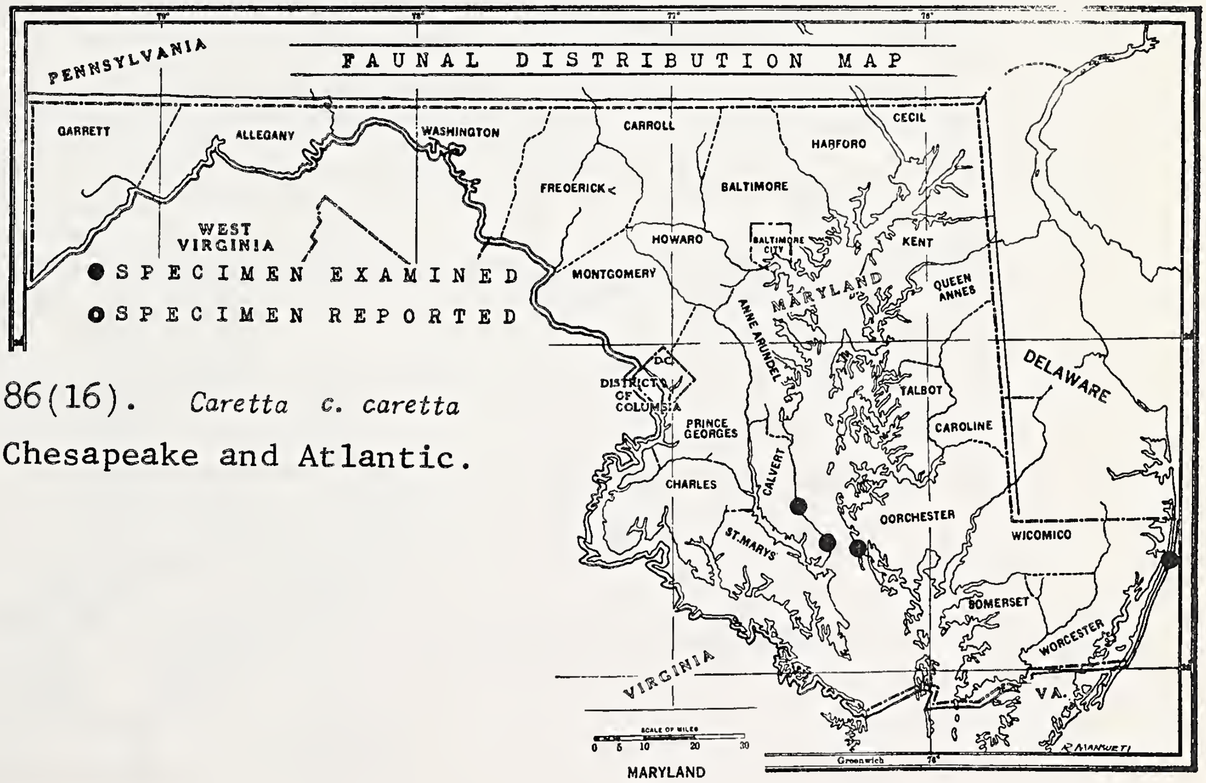
84(14). *Chelonia m. mydas*

Chesapeake and Atlantic.



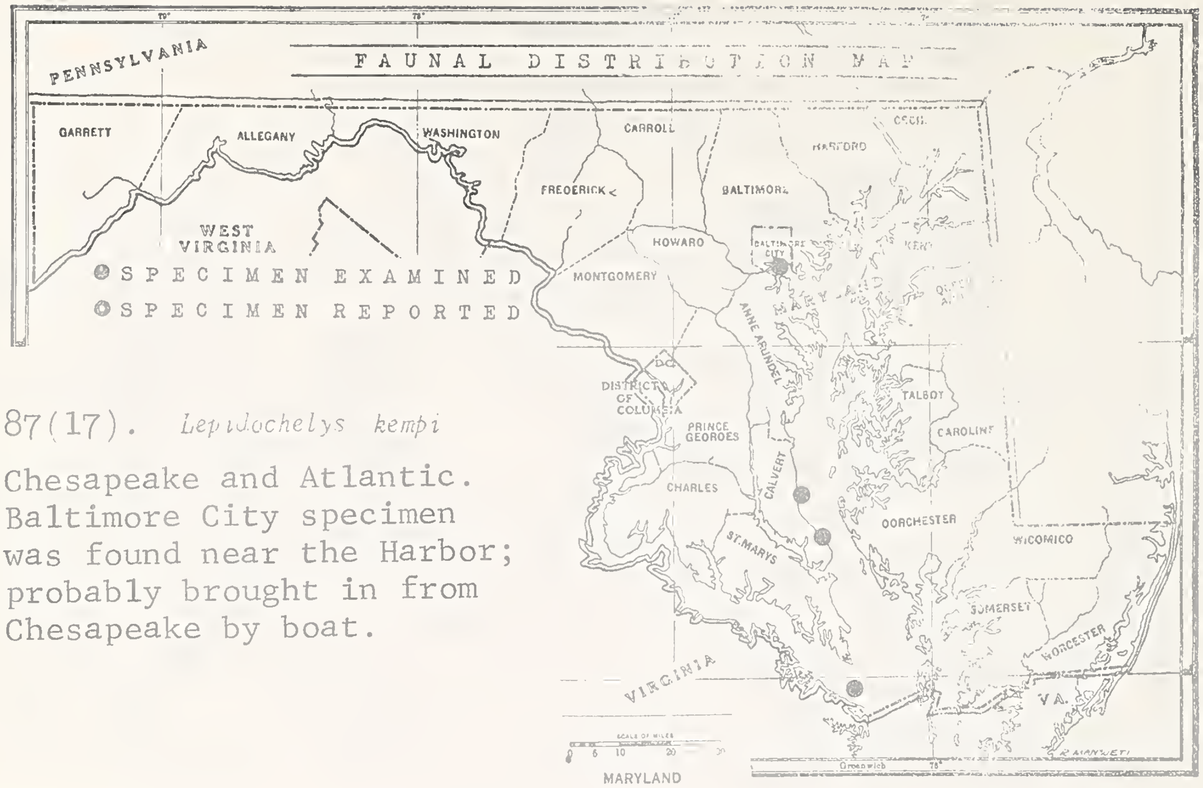
85(15). *Eretmochelys i. imbricata*

Atlantic; no specific Maryland records.



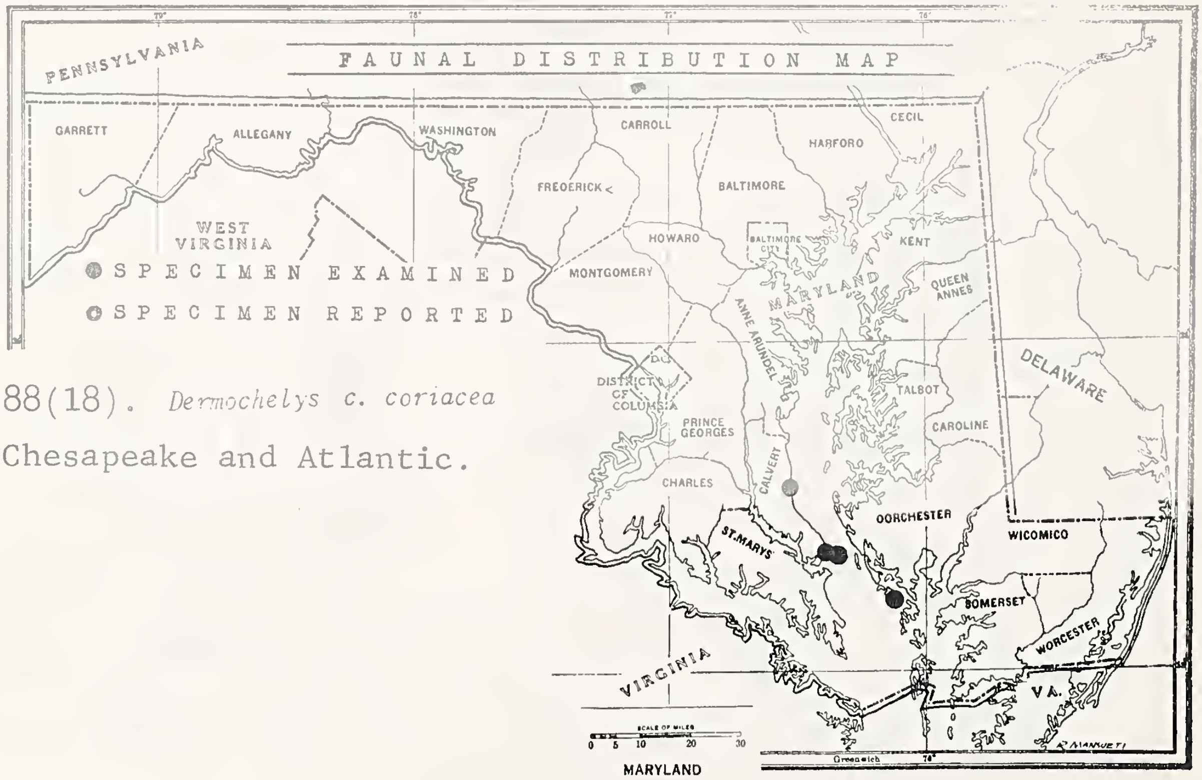
86(16). *Caretta c. caretta*

Chesapeake and Atlantic.



87(17). *Lepidochelys kempi*

Chesapeake and Atlantic. Baltimore City specimen was found near the Harbor; probably brought in from Chesapeake by boat.



88(18). *Dermochelys c. coriacea*

Chesapeake and Atlantic.

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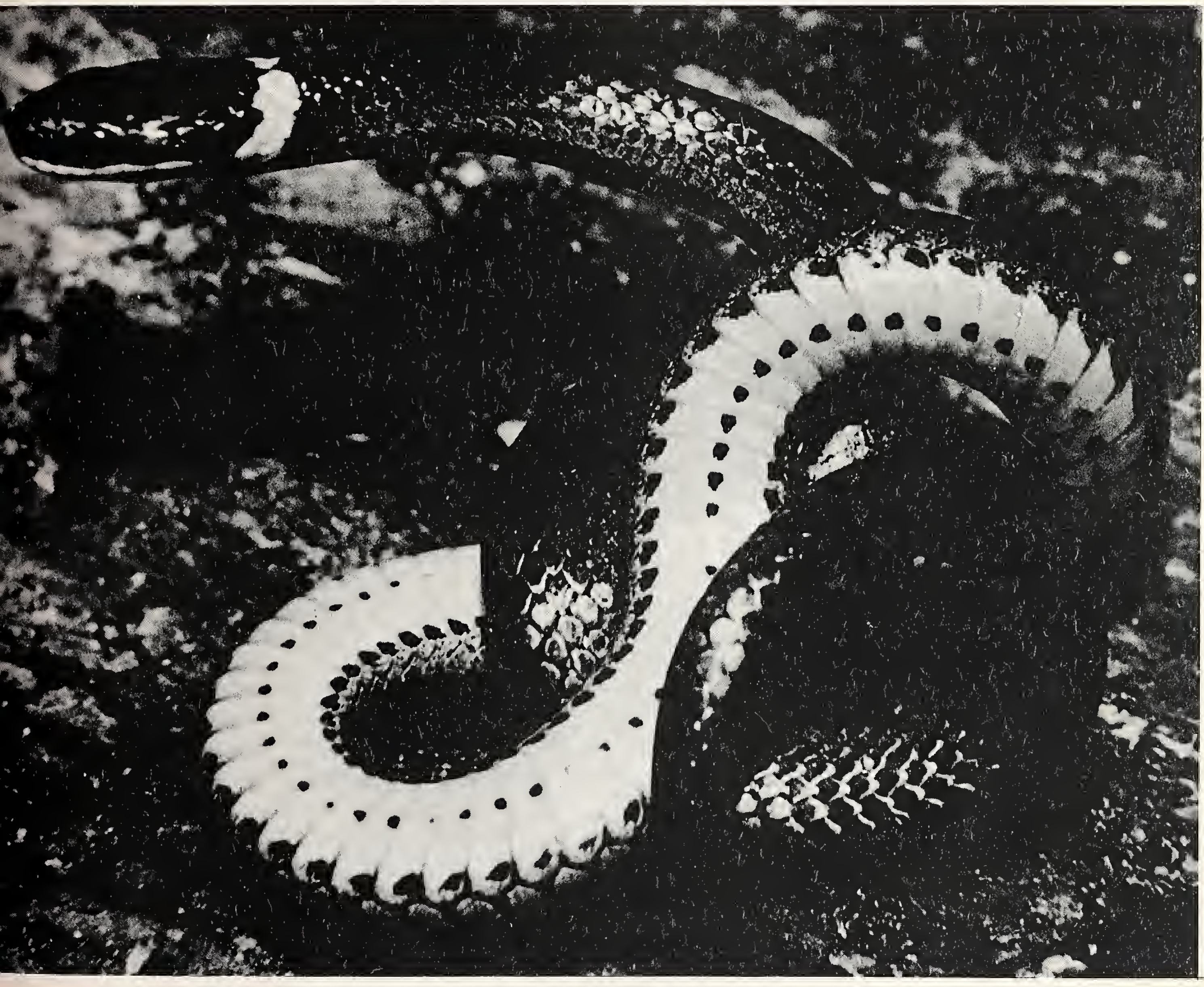

MARCH 1970 VOLUME 6, NUMBER 1

Bulletin of the Maryland Herpetological Society

Volume 6 Number 1 March 1970

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The Cover: A specimen of *Diadophis p. punctatus/edwardsi* from Caroline County, Maryland.

Library of Congress Catalog Card Number: 76-93458

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The Maryland Herpetological Society, Department of Herpetology, Natural History Society of Maryland, Inc., 2643 North Charles Street, Baltimore, Maryland 21218.

BULLETIN OF THE

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Volume 6 Number 1 March 1970

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Department of Herpetology, Natural History Society of Maryland, Inc.

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Variation in a Sample of the Red-spotted Newt, *Notophthalmus v. viridescens*, from Southern New Hampshire

Terry E. Grahm and Khachig Tololyan

Introduction

According to Bishop (1941) the newt is one of our most common and widely distributed salamanders. Until recently its correct scientific name was in doubt, several having been used in the past century. The present study began as an examination of the various published descriptions of the red-spotted newt, *Notophthalmus v. viridescens* (Rafinesque), and of the characters employed in these descriptions. A variety of characters, some not used in previous descriptions of this species, were analyzed for a sample of 105 adult animals to determine their variability and possible usefulness in studies of inter and intrapopulation variation.

Materials and Methods

The sample of 105 adult specimens was seined from a shallow marsh adjacent to the western shore of Bow Lake, Strafford Co., New Hampshire, on September 29, 1966. All measurements were made immediately on animals freshly killed in a saturated solution of urethane. In this way distortion and shrinkage resulting from fixation were minimized.

Our selection of measureable characters was governed to a degree by those employed by previous authors. In his original description of *Triturus viridescens* Rafinesque (1820) gave the total body length as 4 inches. He mentioned that the forefeet are "semipalmate with four equal toes," and also stated that the tail is longer than the body without listing any actual measurements. Bishop (1941) discussed the mean and range of total length for many samples collected in New York and New Jersey. He later (Bishop, 1943) gave mean and range of total length in a sample of 25 specimens, order of toe length without actual measurement of the toes, and color and number of lateral spots. Hilton (1949) discussed and quantified the lateral red spots of *Notophthalmus*. He reported considerable variation in spot number and concluded that local populations might show significant differences in spot count. Moment (1949), in a study of growth in *Notophthalmus*, quantified caudal vertebrae in a sample of 330 specimens and discussed the rather small variation in vertebrae number. Mecham (personal communication) suggested that internarial width and head width, as well as the ratio of one to the other, might be useful in studies of geographic variation or redescriptions of *Notophthalmus*. Our survey of the literature did not suggest any other characters which might be usefully quantified.

We chose to evaluate the following nine characters in this study: total length from snout tip to tail tip, body length from snout tip to the iliac crest, tail length from iliac crest to tail tip, total number of black-bordered lateral

red spots, length of longest toe on front and rear right feet, internarial distance, interorbital distance, and number of caudal and thoracic vertebrae. Internarial distance was determined to the nearest 0.1 mm by ocular micrometer and the other measurements were made to the closest 0.1 mm with vernier calipers. Radiographs were used to obtain thoracic vertebrae counts for 13 individuals and for caudal vertebrae counts the technique devised by Moment (1949) was used. The tails and pelvic girdles of the specimens were soaked in a 1:1 fresh solution of commercial "Clorox" and 70% ethanol until the vertebrae were plainly visible. In measuring body length we elected to use the crest of the ilium as a reference point, whereas previous authors have taken body length to be that from the snout to the posterior lip of the cloaca. However, body length when determined in this fashion is too variable due to the effect of breeding condition on the size of the cloacal lip. Tail length was obtained in each case by subtracting body length from total length. In counting lateral red spots only those bordered by a narrow black ring were considered and flecks were disregarded as in the study by Hilton (1949). To determine toe length the feet were placed on a flat surface and the distance from the junction of the third and fourth toes to the tip of the third toe was taken. Variation about the mean was computed for the above measured characters and also on the following proportions: internarial distance as percentage of interorbital distance, tail length as percentage of total length, and number of caudal vertebrae per cm of tail.

Results and Discussion

Variation of the entire sample and of males and females separately in each of the measurements is presented in Table 1. The differences between males and females in total length, body length, tail length, number of red spots, interorbital width, internarial width, and number of caudal vertebrae are nonsignificant ($t = 0.84$, $p>0.05$; $t = 0.37$, $p>0.05$; $t = 1.01$, $p>0.05$; $t = 0.85$, $p>0.05$; $t = 1.68$, $p>0.05$; $t = 1.66$, $p>0.05$; $t = 1.27$, $p>0.05$, respectively). The males have significantly longer third digits on the right front and right rear feet than do the females ($t = 2.50$, $p<0.02$; $t = 6.06$, $p<0.001$, respectively). The mean count of thoracic vertebrae for females was not compared with that of the males due to insufficient sample size.

Analyses of variation of the proportions is presented in Table 2. Significant differences were not found between males and females in number of caudal vertebrae: tail length, tail length: total length, and internarial width: interorbital width ($t = 1.49$, $p>0.05$; $t = 1.75$, $p>0.05$; $t = 0.22$, $p>0.05$, respectively).

Total length has been the character most used in the studies of previous authors. The males in our sample had slightly, but not significantly, greater total length than the females. Rafinesque (1820) mentioned a total body length of 4 inches (101.6 mm), but failed to give the sample size or sampling locality. Bishop (1941) gave range and mean of total length for several samples. His series of 35 females from Long Pond, Rensselaer County, N.Y., ranged 79-95 mm, with a mean total length of 86.6 mm. The mean for our sample was 88.7 mm. Males from his sample ranged 90-98 mm with a mean total length of 94.6 mm, whereas the mean in our sample was 89.8 mm. Bishop did not mention sample size for the males. Other samplings by Bishop yielded similar size range. Altogether, the measurements ranged from

Table 1. Variation in measured characters in a sample of *Notophthalmus v. viridescens* from Strafford County, New Hampshire.

Character	Sex	N	Range	$\bar{x}$ ± SE *
Total length	Male	64	63.5-105.0	89.83 ± 1.01
	Female	41	69.0-109.1	88.71 ± 1.48
	Entire Sample	105	63.5-109.1	89.39 ± 0.84
Body length	Male	64	31.6-46.8	40.74 ± 0.39
	Female	41	32.9-50.1	40.99 ± 0.57
	Entire Sample	105	31.6-50.1	40.84 ± 0.32
Tail length	Male	64	31.9-60.1	48.90 ± 0.70
	Female	41	35.3-59.8	47.70 ± 0.97
	Entire Sample	105	31.9-60.1	48.43 ± 0.57
Total number dorsolateral red spots	Male	64	4-19	10.98 ± 0.43
	Female	41	3-19	10.46 ± 0.44
	Entire Sample	105	3-19	10.78 ± 0.32
Length 3rd right front digit	Male	64	2.1-5.7	4.50 ± 0.89
	Female	41	2.0-5.6	4.14 ± 0.11
	Entire Sample	105	2.0-5.7	4.35 ± 0.07
Length 3rd right rear digit	Male	64	3.6-6.1	5.21 ± 0.07
	Female	41	2.8-5.7	4.46 ± 0.10
	Entire Sample	105	2.8-6.1	4.92 ± 0.07
Interorbital width	Male	64	5.6-7.9	6.99 ± 0.06
	Female	41	5.7-7.9	6.82 ± 0.07
	Entire Sample	105	5.6-7.9	6.92 ± 0.05
Internarial width	Male	64	1.2-1.9	1.50 ± 0.02
	Female	41	1.2-1.8	1.46 ± 0.02
	Entire Sample	105	1.2-1.9	1.49 ± 0.01
Number of caudal vertebrae	Male	46	26-38	32.54 ± 0.47
	Female	26	26-40	33.62 ± 0.70
	Entire Sample	72	26-40	32.93 ± 0.39
Number of thoracic vertebrae	Male	10	15-17	15.30 ± 0.21
	Female	3	15-17	15.67 * *
	Entire Sample	13	15-17	15.38 ± 0.21

* $\bar{x}$ ± SE = mean ± standard error

** Sample size insufficient to calculate variation about mean.

Table 2. Variation in proportions in a sample of *Notophthalmus v. viridescens* from Strafford County, New Hampshire.

Character	Sex	N	Range	$\bar{x}$ ± SE
Number caudal vertebrae: tail length (cm)	Male	46	5.16 - 8.72	6.72 ± 0.11
	Female	26	5.69 - 8.43	7.01 ± 0.15
	Entire Sample	72	5.16 - 8.72	6.83 ± 0.09
Tail length (mm): total length (mm)	Male	64	0.451-0.578	0.544 ± 0.003
	Female	41	0.485-0.588	0.536 ± 0.003
	Entire Sample	105	0.451-0.588	0.541 ± 0.002
Internarial width (mm): interorbital width (mm)	Male	64	0.179-0.261	0.216 ± 0.002
	Female	41	0.174-0.265	0.215 ± 0.003
	Entire Sample	105	0.174-0.265	0.215 ± 0.002

65-110 mm (Bishop, 1941). This range is comparable to our range of 63.5-109.1 mm. The record size for this species was reported by Conant (1958) as 127 mm. A series of 105 adults was collected by Noble (1926), from Newfoundland, N.J., and had a mean total length of 84.75 mm and a range of 63.5-105.0 mm. Our entire sample mean of 89.39 is appreciably greater. The sex ratio in our sample was 1.56 male per female, which is consistent with sex ratios observed by other collectors. We found tail length in both sexes to be more than 50% of total length. This is in agreement with Rafinesque's (1820) statement to the same effect. Hilton (1949) stated that variation in total number of dorsolateral red spots was great but that the average total was 9-10. Our sample demonstrated a range of this character from 3-19, with a mean of 10.78. The significantly greater front and rear third digit lengths of males suggests that this character, not studied quantitatively by previous authors, demonstrates a distinct sexual dimorphism, and as such might be useful in distinguishing sex in these animals.

In determining number of caudal vertebrae of 105 specimens, only 72 were found suitable. The others obviously had broken series or were missing some vertebrae (this was after the clearing in clorox and ethanol, which followed the taking of measurements). Although the differences in caudal vertebrae counts are nonsignificant at the 0.05 level, the females have, on the average, 1.1 more caudal vertebrae than the males. Moment (1949) obtained a mean of 31.9 caudal vertebrae in his mixed sample for Massachusetts, Maryland and North Carolina, but did not compute the variation between the sexes. Our values for caudal vertebrae: tail length suggest that caudal vertebrae are slightly longer in males than in females.

Of the characters and proportions analyzed in this study only two show significant intersexual variation. We hope that the parameters used and the data presented here might later be included in studies of geographic variation in this subspecies.

An obvious need exists for such investigation.

Acknowledgements

We would like to thank Dr. John S. Mecham of Texas Technological College and Dr. Herndon G. Dowling of the American Museum of Natural History for their helpful suggestions. Special thanks are due Dr. Donald J. Zinn of the University of Rhode Island for his encouragement of this study. We also extend our appreciation to Robert W. Guimond for reading the manuscript.

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A *Sonora michoacanensis michoacanensis* (Dugés) from Colima, Mexico.

Stickel (1943) reported on all known specimens of *Sonora michoacanensis michoacanensis,* recording them from the Mexican states of Michoacan and Guerrero. Schmidt and Shannon (1947) simply repeat Stickel's data on 3 of the Michoacan Specimens. Duellman (1961) includes Stickel's records and adds the state of Puebla.

On 5 July 1966 (11:00 p.m.) a female *Sonora m. michoacanensis* (Fig. 1, RS596 HSH) was collected on a dry paved road between Tecoman and Boca de Apiza, Colima, Mexico by Richard Lester. This specimen apparently represents the first record for the state of Colima. The specimen measures 223 mm snout-vent and 37 mm tail length. Stickel's (1943) data suggests a sexual correlation in the number of ventrals and caudals, this specimen contradicts these data. Ventrals 162; sub caudals 33, color in life is as follows: a tri-colored snake of yellow, black and red. There are 16 yellow bands on the body. Of the black bands, only 5 are not split by red. Black scale tipping is evident in all red areas. The tail is uniform red except for the black scale tipping.

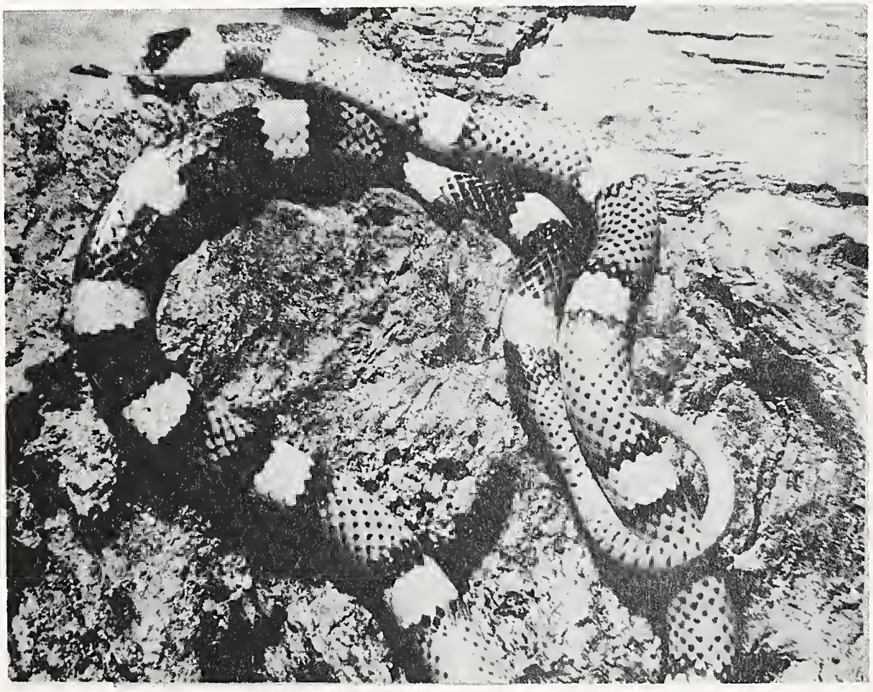

Figure 1. An adult female *Sonora michoacanensis michoacanensis* from Colima, Mexico (RS 596 HSH).

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Another Lesser Siren from Central Florida

Carr and Goin (1955) reported the lesser siren, *Siren intermedia*, as occurring as far south as Pasco County, Florida. Goin (1957) commented on several individuals collected in Highlands Co., at the Archbold Biological Station, Lake Placid (1967, personal comm.), and recently Funderburg and Lee (1967) discussed several specimens from Hillsborough and Polk Counties.

On 11 September 1968 the senior author collected an adult lesser siren (38RAS; 153 mm S-V length, 262 mm total length) from Arbuckle Creek, 2 mi. S of Lake Arbuckle, near State Hwy. 64, Highlands County. This record further substantiates the presence of *Siren intermedia* in central Florida and bridges a gap in the known distribution of this species. Further collecting will undoubtedly show this salamander to be generally distributed throughout much of central Florida.

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Rattus norvegicus Epidermis, an Apparently Undigestable Item in the Diet of a Captive *Andrias davidianus*

During 1966-1968 a 24 inch Chinese Giant Salamander, *Andrias davidianus,* was kept alive on a diet of weanling wistar strain albino norway rats, *Rattus norvegicus,* although young leopard frogs, *Rana pipiens* and common goldfish, *Carassius auratus,* were substituted occasionally. Complete intact skins of the weanling rats were found in the aquarium after defecation everytime the rats were fed to the salamander. It is interesting to note that apparently the *Rattus* epidermis was undigestable in this captive *A. davidianus.*

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A Three-Legged Cricket Frog from Florida

The three-legged *Acris gryllus* pictured here was collected by the writer and Robert Wurster on 28 July 1969 in Levy County, Florida. The frog was a recently transformed juvenile and had no visible scar tissue in the vicinity of the missing leg. The frog was cleared in hydrogen peroxide and trypsin and stained in alizarin red. Examination revealed that the pelvic girdle is lacking on the legless side, and no left ilium is present. The leg apparently never developed. When compared with a normal specimen from the same locality, no other anomalies are apparent. The frog was not noticeably handicapped in its jumping and swimming abilities. Stauffacher (1934) reported a similar anomaly in a salamander. The three-legged frog has been deposited in the Florida State Museum (UF 27607.

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---Steven P. Christman, *Department of Natural Sciences, Florida State Museum, Gainesville, Florida 32601.*

Ecological and Ethological Aspects of Herpetology

Robert G. Jaeger

The field of herpetology has progressed significantly since the turn of the century when emphasis was placed upon typological taxonomy and detailed morphological studies. The trend today, although certainly not an unanimous approach, is to apply the biological concept of the species in taxonomy and to use morphological studies as a wedge to untangle the evolutionary relationships of various taxa. Yet the question must certainly be asked, has herpetology been brought into effective use in the study of modern biological concepts? One need only look at the recent advances made in ichthyology, mammalogy and, particularly, ornithology to realize that herpetology lags far behind in formulating an effective approach to such important fields as ethology and ecology. The reasons underlying this lethargy are probably many, but certainly the seeming economic unimportance of amphibians and reptiles plays a major role. Overlooked, though, is the comparative ease with which many species of these classes can be studied both in the field and in the laboratory. It is the intention here to review only one field of socio-biology in which herpetology has played a minor role but which is open for further research.

The modern concept of territoriality was developed by Howard (1920) through his observations on birds. Territory is the area which an individual defends against intrusion by other individuals usually of the same species and sex. Thus in birds for example, the male may defend an area around his nest in which the female resides; the female herself may not be actively defended. Territories are often established at the onset of the breeding season and, while fighting may occur during the initial stages of establishing it, defense of the territory is subsequently by displays, such as songs in birds. Territoriality is often viewed as a means of reducing aggression within a population, since it acts as a spacing mechanism. An alternative to this, where selection has been for social groupings of individuals, is the formation of a social hierarchy. In this system, a pecking order is formed,

with one individual being dominant to all of the others which are likewise ranked in social dominance. Gallinaceous birds often show this type of ranking in social order while baboons have envolved a modification to it (Washburn and DeVore 1961). Territorial and social dominance systems are wide-spread throughout the birds, mammals and fishes, not to mention the invertebrates. Herpetological studies have also shown these systems to operate among amphibians and reptiles. Carpenter (1967) implies that territorial defense is widespread among lizards, and particularly within the Iguanidae. As in birds, the defense consists of display, fighting and chasing, with display the most common aggressive form. Displays are apparently ordinarily confined to body positioning or movement of the body or parts of the body, often with the presentation of brightly colored patches to an opponent. Territoriality and aggression in anuranus have been the topics of several recent papers. Wiewandt (1969), for example, has shown that bullfrogs actively defend territories along the shoreline, in part by means of auditory signals. Males respond aggressively to other males which are giving the mating call and the defending male will respond with a separate and distinct call, which serves as a warning to the intruder. Emlen (1968) proposed that body posturing also serves in territorial defense and that success in mating is directly related to the possession of a territory.

While studies on territoriality and social dominance are primarily still in the descriptive stage in herpetology, ornithologists are rapidly advancing the field both in the orientation of their research and in the development of theoretical models. Both of these are now focusing on the function of territoriality at the population level. That is, how might intra-species aggression and territorial defense be involved in population regulation? It has long been known that the population density of many species tends to remain remardably stable over extended periods of time. Watson and Jenkins (1968) have shown that in the red grouse, only birds with territories are able to breed and that there is large mortality among nonterritorial birds. They have also shown that the area of an individual's territory is dependent upon the density of the population. When the population density is reduced, territorial size increases. Watson (1968) also supplied evidence to indicate that the size of an individual grouse's territory is directly dependent upon the nutritional quality of the food present within it. Wynne-Edwards (1962) has proposed a hypothesis which, in part, says that the expression of territoriality by a species may serve to regulate natality in relation to population density. Thus, not only does territory tend to control the number of individuals breeding, but it also, through its elasticity, may influence the number of offspring which each breeding pair produces. In this way, a feed-back mechanism between population density and natality results and the density does not reach a level sufficient to decimate the vital resources, such as food, upon which the species must depend. Although there are a number of hypotheses which have been generated concerning population regulation, there is virtually no activity among herpetologists to obtain experimental data on the subject. This is certainly discouraging, considering the present knowledge of territorial and social dominance structures in amphibians and reptiles, the high visibility of breeding populations of some anurans, and the abundance and experimental flexability of salamanders. Workers in herpetology, such as Rand (1967), have approached the problem but have not really engaged it either experimentally or theoretically.

However, intra-species competition, as a factor in population regulation, is not the end link in the chain of research topics generated by current soci-biological

studies. There is now an approach to a problem which has intrigued herpetologists for several decades. The problem is, how does the geographic distribution of one species influence that of another, or, even more basic, how do the ecological and ethological components of several sympatric species allow them to coexist in a relatively stable way. Lack (1944), from his studies on birds, has suggested that when closely related species come into contact geographically, they will tend to compete for certain elements of the environment, such as food, breeding sites and other vital resources. This is due to the similarity of the morphology and physiology of related species. The results of such competition will be (1) one species will eliminate the other by being a superior competitor, (2) the two will occupy separate geographic regions, (3) they may occupy the same habitat but differ in resource requirements or (4) they may live sympatrically but occupy different habitats. The mechanism by which inter-species competition is expressed in amphibians and reptiles are now being investigated by several scientists. Schoener (1968) has shown clearly how four sympatric species of *Anolis* lizards on Bimini partition an environment such that each species tends to inhabit a particular layer or portion of the vegetation. He also concluded that the sizes of the species are such that those which overlap most in habitat selection overlap least in size of prey taken. Rand and Humphrey (1968) also have noted the niche diversification of tropical lizards which allows them to coexist with minimal competition. Jaeger (1969) has shown that, through inter-species competition for food, one species of salamander can eliminate a second species from a favored habitat and force it to exist in a suboptimal habitat where it may be threatened with extinction. While herpetologists have taken an understandable interest in inter-species competition and niche partitioning, there is still a basic lack of knowledge on such crucial topics as the degree and efficiency of food utilization in relation to food abundance, knowledge which is needed for an understanding of many types of population interactions.

Finally, it might be pointed-out that fidelity to a territory or home range often necessitates the ability of displaced individuals to return to that area. Although such studies were originally initiated on birds, amphibians have become a primary field of current study. The work of Twitty (1966) laid the basic groundwork for research on homing in salamanders, providing evidence that olfactory cues are of primary importance. Subsequent work by Madison (1969) has further indicated the importance of orientation by olfaction. Ferguson et al (1968) and Ferguson (1967) have done a considerable amount of research on anurans which indicates that, in contrast to salamanders, they use celestial cues in orientating to the home shoreline. Such studies on orientation clearly reflect the versatility of amphibians for use in experimental field and laboratory studies.

The conclusion may be drawn, then, that herpetologists have not been outstandingly successful in initiating research and theories in the fields of population ecology and ethology although there is an encouraging trend in that direction. On the other hand, one should be aware that amphibians and reptiles are as socially and ecologically complex as the other classes of vertebrates and that many of them possess highly desirable traits for pursuing an understanding of such complex systems as territoriality and social organization, intra-and inter-species competition, population regulation and orientation.

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Hyla femoralis in Maryland, Revisited

My friend Jim Fowler (1969) may be right about the potential for the future occurrence of *Hyla femoralis* in Maryland, but I personally think this frog should be dropped from the state's faunal list. It is important to discuss this matter, however, and not summarily dismiss it out of hand. The area under consideration is at the very northern limit of the range of the species, and the question of its presence or absence here has particular zoogeographic implications. These include the efficiency of the Potomac River as a barrier to dispersal. If *H. femoralis* ever naturally occurred in Maryland (which I still doubt) it most certainly is not to be found there today. True, it was 23 years between the initial discovery of *Farancia erytrogramma erytrogramma* in Southern Maryland and the taking of the latest specimen (Cooper, 1960), but I don't think the suggested analogy with *H. femoralis* is a very apt one.

In the first place, even in areas where it can be collected with any certainty, my experience with the fossorial and highly cryptic *F. e. erytrogramma* has been that it is devilishly hard to come by. I have not found this to be true of *H. femoralis*, which can be found in very large numbers in spring breeding choruses within its range. Unfortunately, rainbow snakes do not sit in shrubbery and sing. Secondly, in comparable habitats the mean population size and relative density of most amphibians far exceeds that of most reptiles, especially snakes, since snakes characteristically occupy terminal positions on food and energy pyramids. This is certainly true of *H. femoralis* and *F. e. erytrogramma*. Thus, the frog should be much easier to find than the snake both because of its more open behavior and because it is simply more abundant. This is doubtless belaboring a couple of obvious points.

It is always possible, of course, that the questionable specimens (Fowler and Orton, 1947) were part of the waifing or otherwise-dispersed vanguard of a fringe or founder population which was not experiencing any great success at surviving and has since gone under. But, the Battle Creek Cypress Swamp certainly would not impose any unusual ecological exigencies on *H. femoralis*, neither abiotically nor biotically.

The other "tree frogs" inhabiting the Coastal Plain communities of Southern Maryland are all intimate associates of *H. femoralis* in the south, so a vanguard of *H. femoralis* moving into this area would find itself presented with an essentially unoccupied niche, and such a population should burgeon in the favorable environment. Similarly, for reasons given above, if a Battle Creek Cypress Swamp population were either relict, or part of a wider distribution, it is highly unlikely that its presence could remain a secret. Of course it is also possible (but in my opinion improbable) that *H. femoralis* could have been extirpated from the swamp, since its history includes a period of considerable logging activity. However, large stretches of it are in excellent although not virginal shape, and I have found *H. femoralis* surviving in heavily lumbered stands of pine in South Carolina and Florida.

Considering all of the above, then, my final point (also mentioned by Fowler) is simply that, despite intensive collecting by many people at pluperfectly optimal times, we have never found *H. femoralis* in Southern Maryland. Ergo, to reiterate a previously expressed opinion (1953, 1960), it is not a native of Maryland. Arguments to the contrary are simply, in a manner of speaking, refusals to slide down the Occam's razorblade of life (ouch!). *Siren lacertina* and *Pituophis m. melanoleucus* anyone?

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(Submitted 12 October 1969.)

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A New State Record! ....No.

On 30 May 1969, Martin Long and I were on a collecting trip just south of the Conowingo Dam in Cecil County. A very fine specimen of *Emys blandingi* was collected.

In the next few weeks, several of the local authorities on reptiles were notified, and some became very interested although doubtful, checking through old records to see if any other Blanding's turtles had been recorded in Maryland. There was always the possibility that the turtles had been here all along, but for some reason had escaped being collected or even seen. This was somewhat doubtful, as it would have meant a range extension of several hundred miles (Conant, 1958).

BUT...While talking to a friend who is also a turtle enthusiast, I mentioned the fact that we had found a Blanding's turtle near Conowingo. His reply was, "Oh, I released her there last year."

This is just one example of the confusion and misunderstanding that can result from the release of any non-indigenous amphibians or reptiles in any area. This problem was previously discussed by Daniel J. Lyons (1968).

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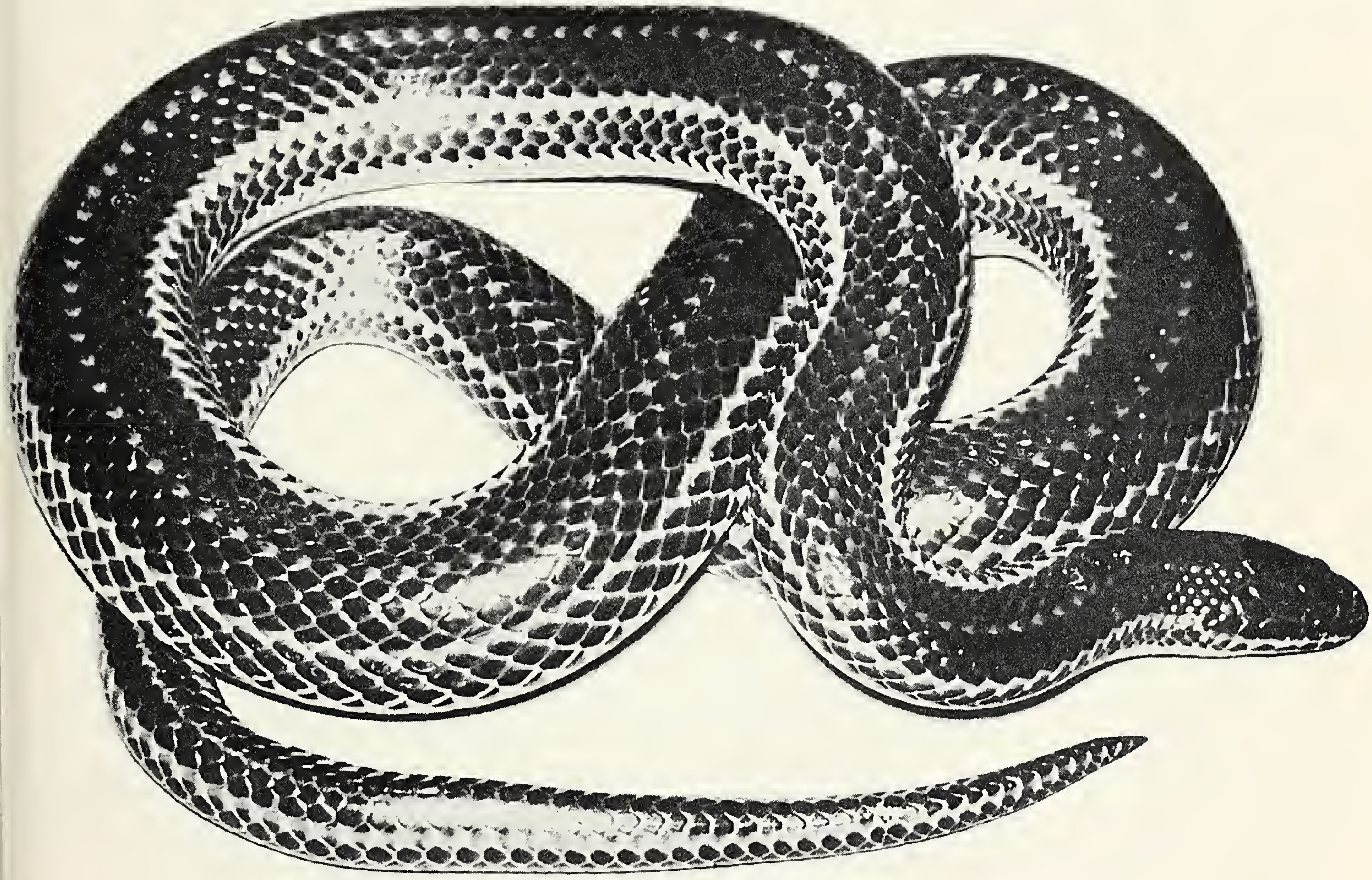

JUNE 1970 VOLUME 6, NUMBER 2

Bulletin of the Maryland Herpetological Society
Volume 6 Number 2 June 1970

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The Cover: An adult *Farancia e. erytrogramma*. Photographed by Dr. Charles J. Stine.

Library of Congress Catalog Card Number: 76-93458

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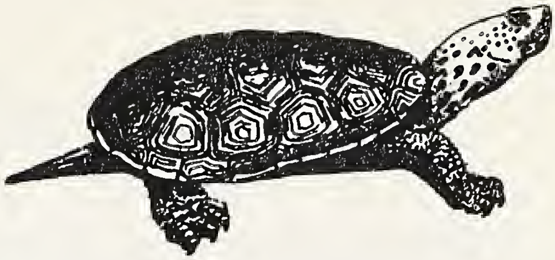

Volume 6 Number 2 June 1970

The Maryland Herpetological Society
Department of Herpetology, Natural History Society of Maryland, Inc.

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Anecdotal Observations Supporting the Undigestibility of *Rattus norvegicus* Epidermis for Lower Vertebrates

The note by Harris (1970) concerning the inability of *Andrias davidianus* to digest skins of *Rattus norvegricus* is interesting in light of somewhat similar experiences I have had with the Mata mata turtle, *Chelys fimbriata*. On several occasions, "pink" rats of undetermined strain were offered as food. These occasions spanned a 2-year period, 3 individual *Chelys*, and possibly 2 or more strains of *Rattus norvegicus*. On all occasions the skins of the *Rattus* were passed intact. These same individual *Chelys*, under identical conditions, demonstrated little difficulty in digesting the epidermis of goldfish, *Carassius auratus*, tadpoles of *Rana catesbeiana*, adult *Hyla regilla*, or portions of beef. The skin of the *Rattus* was passed in such a pristine condition that some initial doubt existed as to the exact method of its exit. Considerable pains were taken to verify that the *Rattus* were traversing the whole of the digestive tract and not simply being regurgitated. This was established after careful (and lucky) observation. Of additional interest at the time was a considerable amount of oily liquid which was passed each time *Rattus* were fed to the *Chelys*. This was never observed with the other food items and was of such an unpleasant nature as to require a tank-cleaning with each feeding.

Fortuitously, several *Andrias davidianus* were available at a later date for observation. Pink *Rattus* were used for their food on a regular basis. Considerable variation was noted for the degree of digestion of the *Rattus* epidermis, but seldom was the intact skin passed in such an excellent condition as managed by the *Chelys*. No oil accompanied the defecation of the *Andrias* and, in general, the use of *Rattus* as food did not result in tank-fouling as it did with *Chelys*.

While these observations are as uncontrolled as observations can be, they do suggest that the epidermis of *Rattus norvegicus* is indeed at least partially undigestible to certain of the lower vertebrates.

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Notes on *Pseudacris streckeri streckeri in Northwest Louisiana*

Pseudacris streckeri streckeri Wright and Wright is known in Louisiana from only one specimen reported by Morizot and Douglas (*Herpetologica* 23:132). The senior author collected that specimen on a parish road 1 mile S. Cross Lake, Shreveport, Caddo Parish, Louisiana. The present paper deals with further collections made by the senior author at that locality.

On February 24, 1968, the senior author again visited the locality, a flooded pasture adjacent to Jolly-Napier Road. A moderate chorus of *P.s. streckeri* was heard and five specimens were collected, which are deposited in the vertebrate museum of Northeast Louisiana State College (NLSC 15070-15074). *Pseudacris triseriata feriarum* and *Rana pipiens sphenocephala* were calling in the flooded pasture, and *Hyla c. crucifer* was calling from the nearby woods. A number of *P. t. feriarum* were collected, always farther away from the deeper open water where the *streckeri* were found. Three of the *streckeri* were taken in open water almost a foot deep, clinging to small branches floating on the surface. The other two were found in grass clumps, in each case, on the edge of the open water.

The senior author and W.D. Middlebrooks collected three specimens of *P. s. streckeri* on March 9, 1968 at the Jolly-Napier locality. The water in the pasture was noticeably shallower and the frogs were found in deeper grass than previously, less than two feet from a *P. t. feriarum* in two of the three instances. The third frog was collected in open water in a drainage ditch cut, a habitat closely resembling the deep open water in which the previous collection of *streckeri* had been made. Several *P. s. streckeri* were heard calling east of the Jolly-Napier site, while no *streckeri* were calling from that area during the time of the earlier collection. Another specimen of *P. s. streckeri* was heard calling in a new locality, 200-300 yds. W. North Lakeshore Drive, 1/2 mi. S. jct. Blanchard-Furrh Road, Shreveport. The specimen was not collected. This record is of interest because the locality is removed from the Jolly-Napier area by 3 miles and is separated from it by Cross Lake, indicating that the species is more widespread in Caddo Parish than the present collections indicate.

The senior author and L. E. Long visited the Jolly-Napier locality on March 30, 1968. No specimens of *P. s. streckeri* were seen or heard calling. *P. t. feriarum, Rana pipiens sphenocephala,* and *Hyla c. crucifer* were calling at this time. The water level in the pasture was much lower than in February, less than four inches deep throughout the pasture. The remaining water contained many tadpoles and a few *Ambystoma* larvae.

On the basis of these additional specimens, the authors concluded that a breeding population of *Pseudacris s. streckeri* has been established in at least one locality in Caddo Parish. The North Lakeshore Drive specimen demonstrates the need for a critical evaluation of the distribution of the species in Northwest Louisiana.

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Ecological Associations of Amphibians and Reptiles with certain Maryland Mammals.

David S. Lee

It has recently been reported that herpetofauna is often associated with the structures of several species of mammals; i.e., *Geomys* mounds (Funderburg and Lee, 1968), *Peromyscus* burrows and *Neofiber* nests (Gentry and Smith, 1968; Lee, 1968). These associations are partly explained by the protection offered by these structures from possible predators and/or harsh environments. Consequently, local herpetofauna appears to become concentrated in these micro-habitats when other suitable cover is scarce. Here I would like to discuss several additional associations which have come to my attention.

The meadow vole, *Microtus pennsylvanicus*, is tolerant of many ecological communities and is found in situations varying from fresh water bogs and river swamps to open fields. In many of these communities, *Microtus* "runs" appear to provide an important shelter for local herpetofauna. In spring-fed marshes (in order of relative abundance: grasses and sedges; arrowheads, *Sagittaria;* cattails, *Typha;* and skunk cabbage, *Symplocarpus foetidus* make up the plant community) the runs of this rodent are on or near the surface being concealed by dense, matted grasses and sedges. Raking back large mats of dead vegetation uncovers a seemingly endless maze of narrow vole runways. These runs vary in moisture content from dry to nearly full of water. In these situations I have found *Plethodon cinereus**, *Hemidactylium scutatum**, *Pseudotriton montanus*, *Pseudotrition ruber**, *Rana palustris*, *Rana clamitans*, *Pseudacris triseriata**, *Bufo americanus*, *Clemmys guttata*, *Clemmys muhlenbergi**, *Thamnophis sirtalis*, and *Thamnophis sauritus*. (An * indicates that this species occurs in *Microtus* runs with moderate frequency in relation to its relative abundance in the community.) The different species dwell in zones which appear to be governed by their moisture preference. In marshes where there is little overstory, the majority of herpetofauna have been observed in the early spring; later in the year the ground vegetation becomes dense, making it difficult to expose runways. At this time the water table often drops, making the surface runways too dry for moisture-seeking species. Under these circumstances I have found several species of amphibians and reptiles (i.e., *Chelydra serpentina*, *Clemmys guttata* and *Rana clamitans**) in the burrows of muskrats, *Ondatra zeibethica*, 5-12 inches below the surface. These animals were discovered in shallow depressions scattered along the bottom and sides of the burrows. I have not had enough field experience with muskrat's burrows to make any statement concerning the ecological importance of this mammal to the amphibian and reptile community.

Microtus runs are also common in river swamps. Here black willow, *Salix nigra*, and sycamore, *Plantanus occidentalis*, usually form the dominant overstory. Vole activity is most conspicuous among the roots of grasses, rag weeds, and ground ivy, *Glechoma hederacea*, near the margins of small, temporary ponds. During the winter, spring and early summer these ponds usually hold water to a depth of several feet. The ponds completely disappear by late summer. Raking back the ground vegetation (*Glechoma* predominates) in these areas reveals vole runs which contain: *Plethodon cinereus**, *Ambystoma maculatum**, *Ambystoma opacum** (and eggs*), *Hemidactylum scutatum*, *Rana sylvatica* and *Bufo americanus*. The two species of *Ambystoma* appear

seasonally during respective periods of reproductive activity. Since the pools are dry when *A. opacum* breeds, the females often remain coiled around their eggs for several weeks or more until the ponds fill and the eggs hatch. In areas where logs and other debris are scarce, *A. opacum* may exclusively utilize *Microtus* runs for nests sites.

Herbert S. Harris, Jr. has informed me that *Lampropeltis calligaster* and *Lampropeltis getulus* have been collected by rolling back sod in grassy fields. The snakes were found in the runways of voles. I have collected *Lampropeltis triangulum*, *Virginia valeriae* and *Terrapene caroliana* hatchlings in similar situations.

The runs of *Microtus* also shelter many species of insects, arachnids, terrestrial mollusks, earthworms, shrews (*Sorex* and *Blarina*) and mice (*Mus* and *Peromyscus*); these organisms may provide food for some of the amphibians and reptiles living in this micro-habitat.

Irving Hampe has informed me that a trap placed in the burrow of a pine vole, *Pitymys pinetorum*, caught an adult *Coluber constrictor*. The particular *Pitymys* colony in which this observation has been made was in a clay embankment nearly void of vegetation and ground cover. Additional collecting may show the burrows of this mammal to be important shelters for herpetofauna. To my knowledge, no study has been made on the burrow associates of this vole.

The starnose mole, *Condylura cristata*, prefers wet soil, usually near springs, for burrowing. The burrows of these mammals, although near the surface, are generally deeper and larger than those of *Microtus* and frequently contain water. I have found the burrows of this mole to shelter fewer species and individuals of amphibians and reptiles than those of *Microtus*, although the two mammals commonly occur together. This is probably explained by the carnivorous nature of *Condylura*. The fact that the burrows are occupied at all appears to be due to the moles shifting their foraging area as the level of the ground water fluctuates. In the burrows of this animal I have found *Desmognathus fuscus*, *Plethodon cinereus*, *Rana clamitans* and *Clemmys muhlenbergi*.

The shrew *Sorex cinereus* nests in decaying logs and stumps. Usually several tunnels lead through the decaying wood to a main nest chamber. In the larger stumps and fallen trunks of hardwoods I have found *Plethodon cinereus** (and eggs), *Plethodon glutinosus** and *Diadophis punctatus* within these tunnels. It seems that only vacant *Sorex* structures are utilized. Unlike the meadow vole the structures of *Condylura* and *Sorex* do not appear to be important shelters for secretive amphibians and reptiles.

The above information was accumulated from field work in Anne Arundel, Baltimore, Cecil and Harford Counties, Maryland. I would like to thank Herbert S. Harris, Jr., Robert G. Tuck and Peter Wemple for their assistance in the field, and Irving E. Hampe for helpful information.

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Abnormal Pigmentation in Maryland Amphibians and Reptiles

Abnormal pigmentation includes both a lack as well as an excess of normal pigment in the animal. Harris (1968a) attempted to gather all known occurrences of albinism in Maryland amphibians and reptiles together in one list. Additional notes (1968b) were published three months later, although he did not define the conditions or comment as to the extent of albinism in each case. No list of color abnormalities other than albinism have been published from Maryland. It is the purpose of this report to list all known abnormally pigmented specimens from the state as well as to define these conditions.

Definitions

I. Albinism (in part from Brame, 1962).

A. Complete albinism - totally lacking eye and integumentary pigmentation and the power to gain pigment under any natural circumstances. This definition permits the occurrence of pigment on the brain and gonadal areas as well as on other internal structures.

B. Partial albinism -

1. Albinos with xanthophores - albinistic except for the presence of yellow pigment.

2. Albinos with erythrophores - albinistic except for the presence of red pigment.

3. Albinos with iridophores - albinistic except for whitish or brassy pigment.

4. Albinos with orbital melanophores - melanin present only in the eye region, but not the entire pupil of eye. (see leucism).

5. Albinos with body melanophores - varying amounts of melanin on the body.

6. Combinations of above.

II. Leucism

A. Complete leucism - lacking integumentary pigmentation, but having a normally pigmented eye.

B. Partial leucism -

1. As in complete leucism except in having some xanthophores, erythrophores, iridophores or melanophores on the body.

2. Lacking normal pigmentation in having very little pigment (much lighter than normal) with a normally pigmented eye.

III. Melanism

A. Complete melanism - a totally black pigmented specimen.

B. Partial melanism - over abundance of melanophores.

IV. Erythrism

A. Complete erythrism - a totally red pigmented specimen.

B. Partial erythrism - over abundance of erythrophores.

V. Xanthism

A. Complete xanthism - a totally yellow pigmented specimen.

B. Partial xanthism - over abundance of xanthophores.

Account by species

An account by species follows for each heading previously described with reference to the account where published. New and unpublished data is presented here

in detail.

I. Albinism

A. Complete albinism

Plethodon cinereus cinereus Green. Collected in Baltimore County by Frank Groves (Harris, 1968a). *Carphophis amoenus amoenus* Say. USNM 145372, from Damascus, Montgomery County (Harris, 1968b). Died at National Zoological Park (18014NZP) on 11 December 1959.

B. Partial albinism

1. Albinos with xanthophores.

Rana catesbeiana Shaw. Tadpoles and recently transformed frogs (Harris, 1968a) from Baltimore and Frederick counties. Evenly distributed xanthophores.

Ambystoma jeffersonianum Green. Larvae (Harris, 1968a) from Washington County. Evenly distributed xanthophores over body.

2. Albinos with erythrophores

Plethodon cinereus cinereus Green. A specimen from College Park with an abundance of red pigment, (Harris, 1968b).

Elaphe obsoleta obsoleta Say. A 3 1/2 foot specimen collected 27 April 1969 on Farm on Roxbury Mill Rd., Glenwood, Howard County by Christopher Wilson. Presently in the collection of the Baltimore Zoo. A few erythrophores are scattered over the body of this specimen.

Elaphe obsoleta obsoleta Say. An adult specimen given to the National Zoological Park by Frank A. Davis (Cooper, 1958). An abundance of erythrophores over body. This specimen is presently on loan to the Baltimore Zoo from Dr. Bechtel (Personal communication, John D. Groves).

3. Albinos with iridophores

Ambystoma maculatum Shaw. An adult specimen from Cecil County (Harris, 1968a). Whitish with cream colored spots.

Ambystoma jeffersonianum Green. (Harris, 1967). Metamorphosed specimens were pinkish and showed numerous iridophores.

4. Albinos with orbital melanophores

Desmognathus fuscus fuscus Rafinesque. Collected (June, 1969) at junction Gun Powder River and Falls Road, nr. Pretty Boy Dam,

Baltimore County by David Lee. Larvae, 32 mm. Albino with orbital melanophores; paired spots anterior edge (iris) of eye, larger paired spot posterior edge (iris) of eye.

5. Albinos with body melanophores

There are no known Maryland examples of albinos with just body melanophores.

6. Combinations -

Albinos with orbital and body melanophores.

Elaphe obsoleta obsoleta Say. (Harris, 1968a). Albinistic with a few body and orbital melanophores. Specimen from near Solly, Anne Arundel County.

7. Reproted as albinos, status unknown -

Rana pipiens sphenocephala Cope. Albino reported by Hensley (1959), from Prince George's County.

Ambystoma maculatum Shaw. Albino reported by Hensley (1959) from Prince George's County.

Elaphe obsoleta obsoleta Say. An adult specimen (USNM 130299) from near Upper Marlboro reported by Cooper (1958), "In preserative the specimen is pale white tan with faint suggestion of a pattern of slightly darker tan blotches".

Chrysemys picta picta Schneider. "chalk white in formaldehyde" (Cooper, 1958).

II. Leucism

A. Complete leucism

The author knows of no examples of complete leucism in Maryland amphibians or reptiles.

B. Partial leucism

1. *Ambystoma opacum* Gravenhorst. Three larvae collected April 1968 at Avalon, Patapsco State Park, Baltimore County by Lee Knott and Dave Schoeberlein. In life the larvae (ready to metamorphose) were whitish with white flecks (iridophores); eyes were normal. One specimen which transformed is catalogued AS482HSH. This specimen appears to be completely leucistic.

2. *Thamnophis sirtalis sirtalis* Linnaeus. Collected 23 May 1962 at Frostburg, Allegany County. "The body coloration was light greenish-yellow, with some black flecks scattered throughout ..... The head was very much darker in color and this coloration extended for on half inch behind the parietals. The venter was light gray with almost no dark pigment, " (Franz, 1968). This is an example of a partially leucistic specimen.

Thamnophis sirtalis sirtailis Linnaeus. Collected 13 September 1961, 1 Mi. S. Westport off Hollins Ferry Road (RS333HSH). Color in life was tan with green color on head and one third of body. A dorsal stripe was present. Another example of a partially leucistic specimen.

Clemmys guttata Schneider. Hatched 1 August 1969 by Chris Dodge. Female from nr. Croom, Prince George's County. Approximately 60% of this turtle has no dark pigment; a partially leucistic specimen.

III. Melanism

A. Complete melanism

Storeria occipitomaculata occipitomaculata Storer. Collected 8/63 (RS395HSH) on the Sang-Run Cranesville Road, 2 Mi. E. White Knob.

Heterodon platyrhinos platyrhinos Latreille. Collected during Summer 1966, about 1 Mi. N. Havre de Grace along flood plain of Susquehanna River, Harford County by Ken Hammond.

B. Partial melanism

Storeria occipitomaculata occipitomaculata Storer. Collected 25 August 1958, near the Swallow Falls State Park, Garrett County. "A large, dark, black-bellied example was taken ...", (Cooper, 1959).

Heterodon platyrhinos platyrhinos Latreille. Collected at Stump Farm, Montgomery County on 5 July 1967 by Paul Didier. White upper and lower labials; personal communication, J. Groves, Baltimore Zoo.

Heterodon platyrhinos platyrhinos Latreille. Collected near Pikesville, Carroll County by John Groves on 9 August 1968. All black, except for grayish mental.

Numerous partially melanistic specimens of *Heterodon* have been collected in Maryland and completely melanistic specimens are not rare. This is also true of *Storeria o. occipitonaculata* on the Alleghany Plateau.

IV. Erythrism

No known examples of complete or partial erythrism have been reported from Maryland.

V. Xanthism

A. Complete xanthism

I know of no examples of complete xanthism in Maryland amphibians or reptiles.

B. Partial xanthism

Thamnophis sirtalis sirtalis Linnaeus. Collected May 1966, near 5 S. Beechfield Avenue, Baltimore City. "The ground color is an olive yellow or pale yellow with black edges showing between each scale. The top of each scale is edged with orange" (Groves, 1966). A partially xanthic specimen.

Carphophis amoenus amoenus Say. Hatched 1 August 1950, female from near Severna Park, Anne Arundel County. A light brownish-yellow with light cream colored venter; the iris was also light yellow in color, (Simmons and Stine, 1961). An example of almost complete xanthism.

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Egg Development of the Tailed Frog Under Natural Conditions

Numerous authors (Noble and Putman, 1931; Stephenson, 1951; and Metter, 1964) engaged in brief discussions concerning certain aspects of the life cycle of the tailed frog, *Ascaphus truei*. In 1969, Wernz and Storm published a detailed study of its pre-hatching stages. They injected gravid *Ascaphus* females with adult *Rana pipiens* pituitaries which initiated egg laying. Since long-term sperm retention by the female has been established in the literature (Metter, 1964), the workers assumed that the females had already mated. Of ten individuals receiving the pituitaries, five deposited eggs. The largest clutch contained 83 eggs. The eggs were placed in different temperature-controlled boxes (4, 8, 12, 16°C); systematic examination of the embryonic development followed. These stages were compared with the developmental stages of *Rana pipiens* (Gosner, 1960).

On 20 July 1968, while the author was conducting a census of aquatic insects in the St. Regis River drainage, a tributary of the Clark Fork in northwestern Montana, additional information was gathered concerning "nesting site" and egg development of *Ascaphus truei*. Two compliments of eggs, several larvae and an adult female were collected in the upper portion of Twelve Mile Creek (4100 feet), 14 miles north of St. Regis, Mineral County, Montana. The eggs were attached to the underside of a large triangular boulder in a small waterfalls. The globular egg masses were suspended in a small water-filled depression. Water perculating down between several large rocks caused a slight circulation of water around the eggs. Both masses were deposited in double strands, each strand with its own outer membrane (Figure 1). Both of the membranes were firmly attached to each other and required rather strenuous effort with forceps to separate the two strands. Inside the outer membrane, each egg was protected by two additional membranes. A water sample was collected from the deposition chamber and tested. It was found to have the following chemical and thermal properties: pH 7.2; free carbon dioxide, 3 ppm; dissolved oxygen, 11.2 ppm; no carbonates; bicarbonates, 28 ppm; temperature, 11°C.

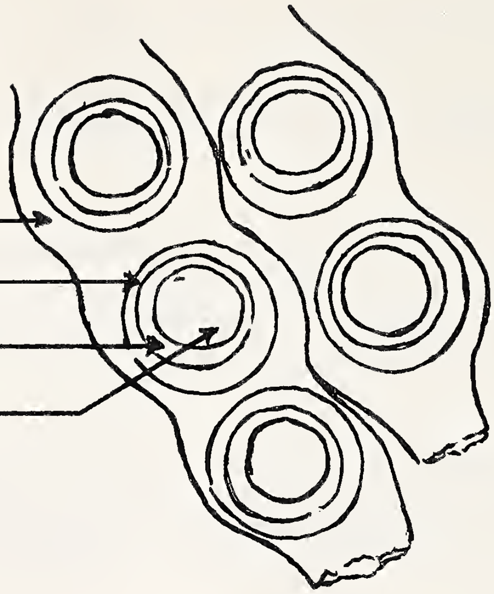

Figure 1. A double strand of eggs of *Ascaphus truei* that was collected in Twelve Mile Creek, Mineral County, Montana.

Materials and Methods

Upon collection, the smaller egg mass containing 64 embryos was preserved; the other having 86 was placed in a styro-foam ice chest and immediately taken to the University of Montana's Biological Station at Yellow Bay, Flathead Lake. After the initial examination, several eggs were preserved in a dilute solution of formaldehyde. The remaining were placed in a nylon stocking which was inturn placed in a screen box. The box was established in a nearby stream which had similar chemical and thermal properties. Rocks were used to anchor the screen cage and to provide for the proper circulation of water over the eggs. The trip from St. Regis, selection of a stream near the Station, preliminary examination and placement of the eggs was completed within five hours. During the holding period the eggs were maintained at 11°C. Each evening the eggs were removed, examined and one or two preserved. Neutral Red Vital Stain was used to observe certain developmental stages. The stages of Wernz and Storm were used in the present study. In the ensueing text, two ways of suggesting time were used. The first indicates the day when a particular observation was made; the second which is in parenthesis, the accumultive number of days the eggs were under surveillance.

Results

At the time that the collections were made, the eggs were either approaching or in the Late Gastrula Stage. Each egg was creamy white and measured 4 mm in diameter. A large translucent spot measuring 1.2 to 1.8 mm was evident on 89 percent of the eggs. According to Wernz and Storm, this characteristic spot is due to differences in light refraction caused by the formation of a cavity beneath the surface of the egg. By July 25th (day 6), all of the eggs had developed two lateral ridges which were separated by the neural groove characterizing the Neural Fold Stage. None of the eggs showed the Neural Plate Stage which Gosner described for *Rana pipiens*. According to Wernz and Storm only two of their 131 embryos showed this feature. Closure of the neural folds forming the neural tube was completed in most eggs by July 27th (day 8). By July 31st (day 12), the Tail Bud Stage had appeared and by August 9th (day 21), the heart beat was noticed in most of the embryos. Eye pigmentation was evident in the embryos by September 1st (day 44). Hatching occurred from September 3rd to 5th (day 46 through 48). At hatching, the tadpoles contained large yolk sacs and had a fine sprinkling of melanin over most of their body except for the distal portions of the fin structure. The heaviest concentration occurred on the upper portions of the eye. Two individuals measured 12.5 mm at emergence; six others, 13.0 mm. Two days (day 49) later, three of the 13 mm individuals measured 13.5, 13.5, 14.2 mm. but their yolk sacs did not appear to shrink.

Discussion

Except for minor differences, the current study supports the work of Wernz and Storm (1969). Differences were noted in clutch size, length of incubation period and hatchling size. Since the distribution of *Ascaphus truei* is a series of wide disjunctions, these variations may represent actual behaviorial modifications. Metter (1964), in studying the tailed frog in Idaho suggested that the eastern or Rocky Mountain populations may have a larger clutch size, a longer incubation and a larger hatching size. The data collected by the author shows similar patterns. The clutches of Wernz and Storm which were taken from females that were collected in western Oregon varied in size from 2 to 83 eggs. In Idaho, Metter found the clutch size to average 68 eggs with a range from 50 to 85. The two Montana compliments contained 64 and 86. Metter indicated that the egg laying season in Idaho extended from late June to early August and observed hatched larvae in "nest sites" in August and September. Apparently the Montana populations have a similar schedule. In the current study, the eggs were deposited before July 20, and hatching occurred after September 3, 46+ days later. The eggs of Wernz and Storm from western Oregon hatched in 28 days. Several authors have commented on size of the newly emerged tadpoles. Wernz and Storm found that in western Oregon larvae were 10 mm at hatching. In the current study, individuals measured 12.5 and 13.0 mm. supporting both Noble and Putnam's (1931) and Metter's observations of 13 to 15 mm.

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A Comment on the Feeding Habits of *Drymarchon coralis couperi*

Wright and Wright (1957) indicate a great diversity in feeding habits of snakes, with foods including ant eggs, mollusks, small mammals, amphibians, reptiles, birds and eggs of birds and turtles, etc. Of all species discussed, only two are recorded as ingesting turtles. Wright and Wright list five authors who have recorded the western coachwip, *Masticophis flagellum testaceus* (Say) as eating young turtles. Hamilton and Pollack (1955) found that 44.4% of the diet of *Agkistrodon piscivorus piscivorus* (Lacepede) consisted of snakes and turtles.

In October 1968, I received a 6.5 foot eastern indigo snake, *Drymarchon corais couperi* (Holbrook) from Lithia, Hillsborough County, Florida. Two days after capture the snake regurgitated one small unidentified bird, egg shells (bird), and a yearling gopher tortoise, *Gopherus polyphemus.* The commensal relationships of *Drymarchon* and *Gopherus* is well documented. However, this is apparently the first record of *Drymarchon* ingesting young *Gopherus.*

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Notes on the Distribution of *Microhlya carolinensis* in Southern Maryland

Jerry D. Hardy, Jr.

The narrow-mouthed frog, *Microhyla carolinensis carolinensis* (Holbrook), was first recorded in Maryland by Noble and Hassler (1936), who collected the species near Solomons Island, and heard it calling several miles away at Cove Point, Calvert County. Since 1936, it has been recorded several times from Cove Point (Mansueti, 1942, 1949, 1950; Hecht, 1946, Wright and Wright, 1949); but specimens from other points on the Maryland coastal plain have not been located, although extensive collections have been made. A total of 13 individuals from Cove Point are deposited in the collection of the American Museum of Natural History, and the Natural History Society of Maryland. Many others have been observed at Cove Point, but not collected.

Reprinted from *Herpetologica* 8(4):162-166, with permission of the Herpetologists' League. For additional data, see *Herpetologica* 9(4):167-168, *Copeia*, 1958, 1:50-52, and for present known distribution see *Bull. Md. Herp. Soc.*, 5(4):124.

Microhyla probably does not possess a wider range in Southern Maryland than present records indicate. Directly inland from and adjacent to Cove Point are a number of hills covered with a pine-hardwood forest. Several specimens have been collected on the Bay-side slopes of these hills, but the occurrence of these individuals was probably the result of aestivating activities. Noble and Hassler (1936) collected the species in a temporary rain-pool "between Cove Point and Solomons Island," but since that time no specimens have been taken outside the Cove Point area. The species seems restricted to this area where it is largely concentrated on the point and rarely taken on the adjacent hills.

Cove Point, a broad, sandy plain extending into the Chesapeake Bay, is a scrub vegetation area upon which are found scrub pine, *Pinus virginiana;* red cedar, *Juniperus virginiana;* prickly pear, *Opuntia vulgaris;* bayberry, *Myrica carolinensis;* and various beach and marsh grasses. Several marsh-swamp habitats are located on the point and are used as breeding areas by *Microhyla*. The soil is poor and plant life rather sparse; yet the point sustains a large herpetofauna.

The Cove Point population of *Microhyla* is apparently isolated from the main part of the range of the species. A. H. Wright (in litt.) gives the nearest point from which it has been obtained as Richmond, Virginia, at a distance of approximately 85 miles south-southwest. Dunn (1918) records the species from Carolina County, Virginia, distant approximately 55 miles southwest.

The present paper attempts to explain the occurrence of this disjunct range of *Microhyla*. Although it concerns only range changes which have occurred wholly within post-glacial times, a discussion of the effect of glaciation is necessary. It is generally agreed among biogeographers than many typically northern plants and animals were forced south by glacial chilling at the time of the last glacier. Deevey (1950) describes fossil remains of northern plants from Louisiana and Texas. Malcom Smith (1950) states that certain reptiles and amphibians (*Rana t. temporaria, Lacerta a. agilis,* and *Vipera b. beras*) may have survived the glacial chilling in England. All of these, however, are species which areable to withstand relatively cold conditions in the northern extremes of their ranges; contrariwise, *Microhyla* is a genus typical of tropical and subtropical climates and rarely ranges into temperate areas. On this basis, it is assumed that it was forced south by the glacier, probably as far as Mexico and Florida. Three theories are available for explaining the existence of an isolated colony of this species in southern Maryland.

Hobart M. Smith (in litt.) comments that many vertebrates of the Eastern United States are actively expanding, not contracting, their ranges. He suggests that the Cove Point population of *Microhyla* is the result of a current northward emigration. This seems improbable because the Potomac and Patuxent Rivers would form natural barriers against a gradual emigration. Allee, Emerson, Park, Park and Schmidt (1949) suggest that animals surmount large rivers as geographic barriers by expanding their ranges to the narrow head-waters of such rivers where they can cross with relative ease and emigrate along the opposite bank. It is improbable that *Microhyla* could have arrived at Cove Point by such an emigration in recent times, as the species has never been recorded in the head-waters of the Potomac and Patuxent Rivers.

A study of the distributional map by Hecht (1946) indicates that the entire northern edge of the range of the species is comprised of disjunct populations

similar to that at Cove Point. Four conspicuous gaps in the distribution are obvious. The smallest of these is from Cove Point to northeast and central Virginia. The distribution in western North Carolina, Tennessee, and Kentucky is intermittently broken with gaps of from 75 to 100 miles. The largest gaps are those from southern Missouri to the center of the Missouri-Illinois line, and from southeastern to southwestern Missouri. Disjunct populations have recently been recorded from Iowa (Klimstra, 1950) and Kansas (Smith 1947). The apparent absence of *Microhyla* in the intervening territories indicates that the entire northern edge of the range of the species, as it is now known, is made up of disjunct populations which are apparently not the result of a gradual northward emigration. Such an emigration would have resulted in a more even distribution.

Mansueti (1949), in following the theories of Darlington (1938) regarding animal dispersal by flotsman and jetsam, suggests that the *Microhyla* may have been brought to southern Maryland via the 1933 hurricane. His provisional theory was based on the fact that the species was not discovered in Maryland until 1936. The ability of *Microhyla* to live near a haline habitat as its Maryland locality, where it occurs directly adjacent to the Chesapeake Bay with salinities averaging 15 parts per thousand (Mansueti, 1950) is shared only by *Hyla cinerea* and *Rana pipiens*. During severe storms, salt spray is blown over the cat-tail ponds where these forms breed, yet they have persisted. The association of *Microhyla* with a haline habitat has been commented upon by Viosca (1923) who collected them along sea beaches in Louisiana. This ability to tolerate brackish conditions would indicate that the species could withstand accidental transportation; however, the fact it has never collected on the peninsula dividing the Potomac or Patuxent Rivers, as well as the fact that the species is considered to be a poor swimmer (Pope, 1919); Holbrook, 1842; Wright, 1932) would tend to disqualify the theory of sudden, accidental introduction, even in view of its vigorous proclivity for haline habitats.

A third theory explaining the Cove Point population of *Microhyla* (as well as relic populations at other points along its northern range) contends that it may be a relic population representing a former normal range periphery. Although the species was probably pushed far to the south by glacial chilling, after which it emigrated northward, it is believed that this northward movement occurred shortly after deglaciation and has been subsequently interrupted by certain changes in climate or environment thus leaving isolated populations separated by conspicuous gaps, wholly within post-glacial time.

Hecht (1946) states that *Microhlya carolinensis* is primarily of the Austroriparian biotic province (as defined by Dice, 1943) but that it also ranges northward into the Carolinian and Illinoian provinces. Darlington (1948) states that "the recession of animals is probably just about as common and important a phenomenon as spreading." The disjointed northern range of *Microhyla* suggests that the species is disappearing from unfavorable biotic areas and receeding into the more favorable Austroroparian province.

The fragmentation of *Microhyla's* range may have been the result of "climatic deterioration" (Deevey, 1949). He has traced post-glacial climate on the basis of pollen analysis. According to his chart, the climate of the northeastern United States immediately following deglaciation was cool, and the forests were primarily evergreens. A warmer climate developed and the non-deciduous forests were replaced by deciduous species. Subsequently, the climate became conspicuously cooler and

moister, and non-deciduous forests began reappearing in many localities. The phenomenon of post-glacial climatic deterioration (from cool to warm then back to cool) and the resulting floristic changes presumably affected the distribution of animals in areas affected by the glacial chill. *Microhyla* probably emigrated northward during the warm hard-wood maximum to Maryland; but since then has disappeared over most of the area due to the cooler climate, and has persisted only in areas well suited to it.

The late formation of the Chesapeake Bay, resulting from the rising sea level accompanying the recession of the Wisconsin icecap, has caused various cases of animal isolation on the Maryland coastal plains. Raney and Hubbs (1948) point out, for example, the isolation of the darter, *Hadropterus notogrammus*, in the Patuxent drainage, is probably the result of this phenomenon. The race-runner, *Cnemidorphorus sexlineatus*, is found abundantly on the western side of the Chesapeake Bay, but is not known from the Del-Mar-Va Peninsula (McCauley, 1945), and is perhaps an example of isolation resulting from the formation of the Chesapeake Bay.

More remote explanations for the fragmentation of the range of *Microhyla carolinensis* include: (1) overabundance of natural enemies; (2) an epidemic of disease in the breeding areas over a period of years; (3) the effects of small scale but definite, climatic fluctuations; or (4) an inability to locate suitable breeding areas due to gradual environmental changes. Wright (1932) discusses the tendency of the species to breed in extremely transient places, and the great loss of eggs resulting from this factor. It is possible that *Microhyla* has persisted at Cove Point only because of the presence of excellent permanent breeding ponds.

The occurrence of several other typically Austroriparian reptiles and amphibians at relatively isolated points on the Maryland coastal plain help to substantiate the theory of relic populations. These include *Hyla femoralis* (Fowler and Orton, 1947), from a cypress swamp in Calvert County; *Rana virgatipes* (Conant, 1945), from sphagnaceous swamps on the Del-Mar-Va Peninsula; *Natrix e. erythrogaster*, from swampy drainage systems on the Del-Mar-Va; and *Abastor erythrogrammus* (McCauley, 1945), from Charles County. All of these forms, including *Microhyla carolinensis*, are ecologically related in that they are found sharing the same habitats in the southeastern United States.

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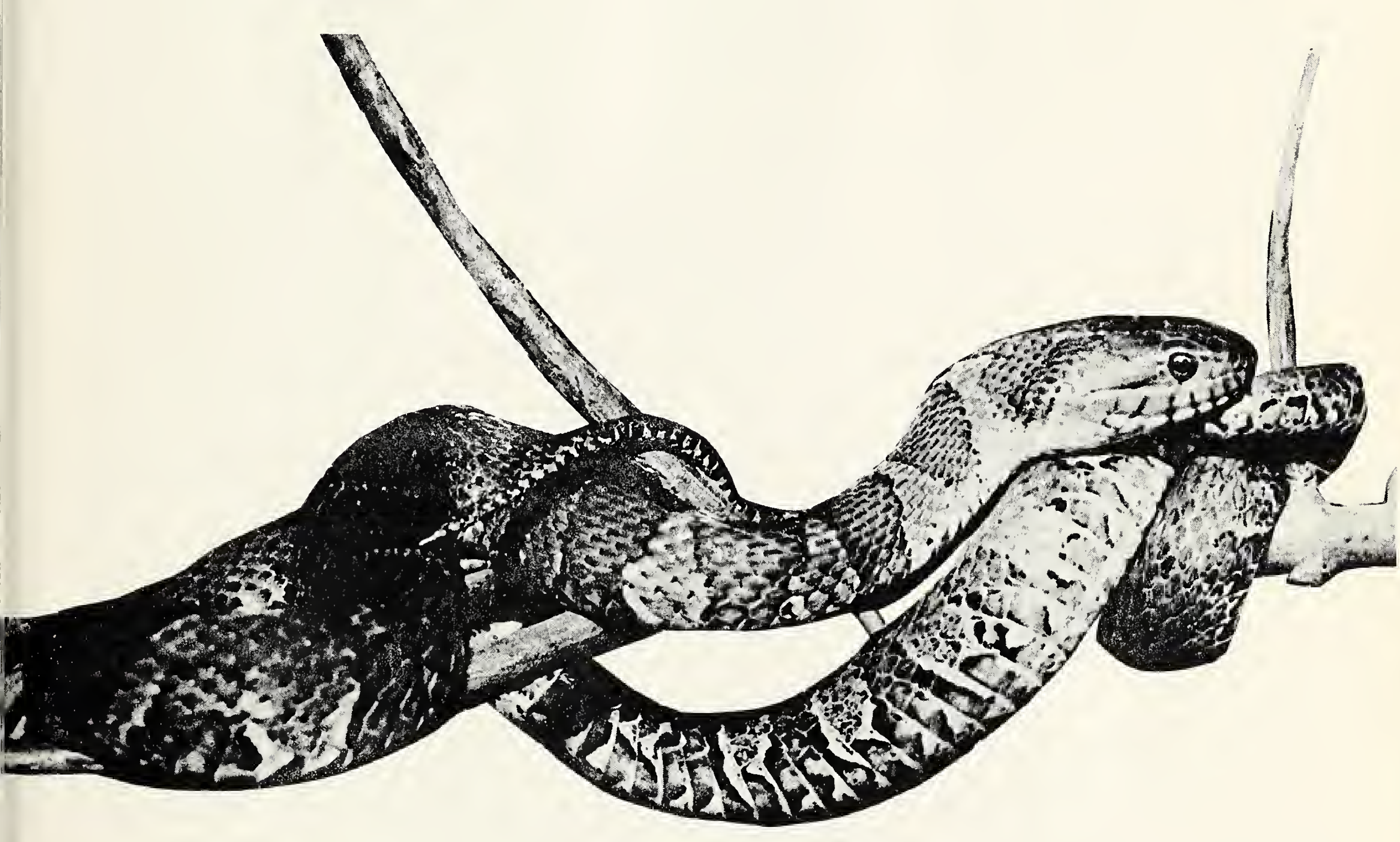
BULLETIN OF THE

Maryland Herpetological Society

The Natural History Society of Maryland, Inc.



SEPTEMBER 1970 VOLUME 6, NUMBER 3

Bulletin of the Maryland Herpetological Society
Volume 6 Number 3 September 1970

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The Cover: An adult *Natrix s. sipedon* from Severna Park, Anne Arundel Co., Md. Photograph by Dr. Robert S. Simmons

Library of Congress Catalogue Number: 76-93458

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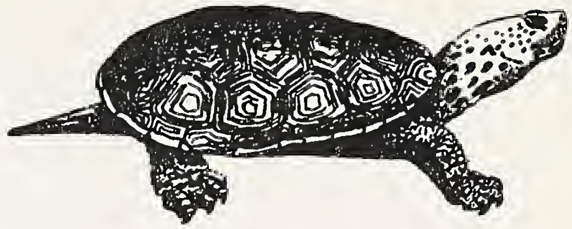

Volume 6 Number 3 September 1970

The Maryland Herpetological Society
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AN AMPHIDICHOTOMOUS NORTHERN BLACK RACER, *COLUBER C. CONSTRICTOR*, FROM MARYLAND AND A RESUMÉ OF RECENT RECORDS OF AXIAL BIFURCATION IN SNAKES

Robert G. Tuck, Jr., and Jerry D. Hardy, Jr.

The consequences of developmental abnormalities in serpents have aroused curiosity since at least the time of Aristotle (Cunningham, 1937 : 12). In themselves, they are of little scientific value, but they do illustrate the viability of the vertebrate fetus until hatching or partuition despite gross aberrations, and there is a recent record of a two-headed California kingsnake, *Lampropeltis getulus califórniae*, that survived more than six years in captivity (Shaw, 1956, 1959). Cunningham (1937) summarized all records of two-headed, two-tailed, and "Siamese-twin" snakes reported up to that time and concluded that there were "about 225 fairly well-authenticated cases." He apparently overlooked a young two-headed European grass snake, *Natrix natrix* (cited as *Tropidonotus natrix*), that died two days after it was presented to the museum of the University of Coimbra, Portugal (Ladeiro, 1935). Recent works of Angel (1950), Reichenbach-Klinke (1963), and Reichenback-Klinke and Elkan (1965) include sections on teratologous, or abnormal, snakes but cite no new cases of axial bifurcation.

By far, most examples listed by Cunningham (1937) were of two-headed serpents, which, depending upon the degrees of cranial, cervical, or thoracic bifurcation evidenced, he classified as "cephalodichotomous" or "anteriodichotomous." Individuals exhibiting "posterior dichotomy," or the condition of having a single head and two bodies or tails, were, according to Cunningham, "exceedingly rare," and rarest of all were "Siamese-twin," or "amphidichotomous," snakes. Nakamura (1938), described six examples, and devised a more complicated descriptive terminology based upon the developmental history of the condition under study. Thus, for complete but co-joined twins, he employed the term "teratopagus," and, according to the body regions joined, or shared, he further subdivided examples into catagories such as "craniopagus" (joined at the head only), "cephaloderopagus" (joined by head and body but with the tails free), and "anakatomesodidymus" (joined along the body but with the heads and tails free). For individuals exhibiting duplication of part of the body, he introduced the term "teratodymus." According to the amount of doubling shown, he erected further subclassifications: "rhinodymus" (two snouts), "opodymus" (two broadly-joined heads), and "derodymus" (two complete heads and necks).

We find Nakamura's terminology cumbersome and requiring an *a priori* knowledge, or supposition, of the animal's embryological development. Hence, we employ Cunningham's simpler descriptive epithets throughout this paper.

Of a clutch of eggs (number not stated) of the northern black racer, *Coluber c. constrictor*, collected by Mr. Ellis McCleod at Olney, Montgomery County, Maryland, a single egg remained unhatched on 22 August 1958. Upon opening the egg, Mr. McCleod found a living, amphidichotomous fetus, which he preserved and presented to the junior author. The specimen was donated to the Division of Reptiles and Amphibians, United States National Museum of Natural History by the junior author in April 1967 (USNM 162645) (Fig. 1).

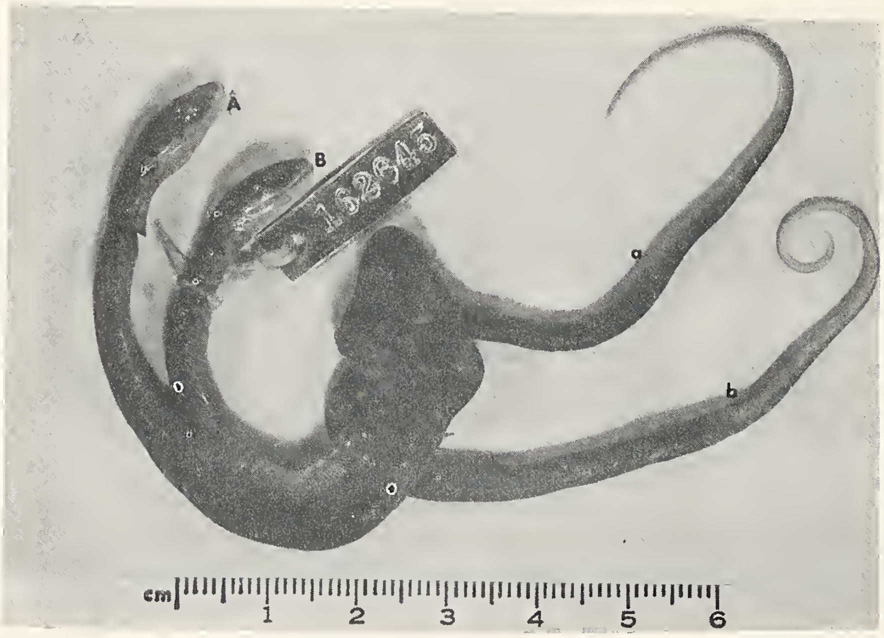

Fig. 1. USNM 162645, amphidichotomous *Coluber c. constrictor*. Photograph by R.G. Tuck, Jr.; courtesy of the Division of Reptiles and Amphibians, United States National Museum of Natural History.

The total length of the smallest Maryland hatchling of *Coluber c. constrictor* reported by McCauley (1945: 73) was 266 mm, while the "Siamese-twins," herein designated as USNM 162645A and USNM 162645B, measure only 218 mm and 206 mm, respectively. Because of the contorted and fragile nature of the specimen, the snout-vent measurements were taken with No. 25 Irish linen thread and are subject to some error. The tails, being free, were measured directly. Data may be summarized as follow:

	A	B
Sex	Male	Male
Snout-vent length	163 mm	157 mm

Tail length	55 mm	49 mm
Dorsal scale rows	15-17-15	15-17-15
Supralabials (r./l.)	7/7	7/7
Sublabials (r./l.)	7/7	8/6
Ventrals	166	168
Subcaudals (pairs)	99	93
Anal plate	divided	divided
Temporal scales (r./l.)	2+1+2/2+2+2	2+1+2/2+1+2
Dorsal blotches	ca. 50	ca.42

Ventrals 40A - 44A are in contact with, but not fused to ventrals 28B - 29B. The first 27 ventrals of USNM 162645B are normal, except that ventral 7B extends only halfway across the venter. Ventrals 45A - 101A are fused to ventrals 30B - 55B. In USNM 162645B the body loops upon itself, so that the more anterior ventrals from 56B through about 96B are fused with the more posterior ones in the same series. The two snakes are free from each other caudad of ventrals 102A and 97B and are essentially normal for the rest of their lengths. A further twist in USNM 162645A may be an artifact of preservation.

Dorsally the two individuals are closely adpressed for a length equalling that of their ventral fusion. There is no dorsal fusion; the demarcation of the snakes' two bodies is clearly evident. As expected, an x-ray shows the vertebral columns to be complete and independent of each other (Fig. 2).

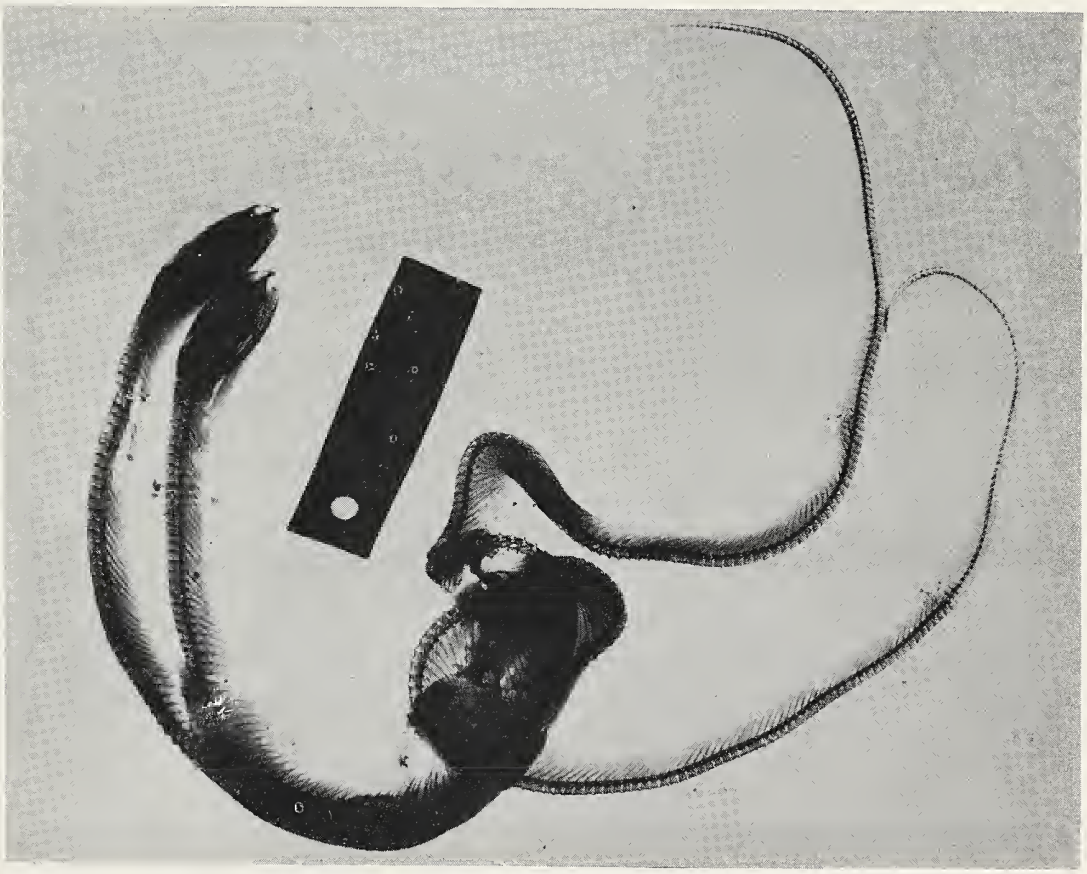

Fig. 2. USNM 162645, amphidichotomous *Coluber c. constrictor* X-ray by Mrs. Fannie Phillips; positive print by Daniel Lyons.

Cunningham (1937: 64-65) could find but four authenticated cases of amphidichotomy. One of two specimens identified to species was a *Coluber constrictor* (cited as *Bascanium constrictor*) found in New York and reported upon by Mitchill (1826) and the other was a *Natrix sipedon*. The remaining two examples were cited as a *"coluber"* (any harmless snake) and a "pair of snakes hitched together like Siamese twins." This last example was reported in *The Washington Star* newspaper in 1897, and, although quoted by Cunningham, full citation was never given. Efforts of the staff of the library of *The Washington Star* at the request of the senior author have failed to uncover the article, and, apparently, the animals were not preserved.

The differences in size, proportions, and alignment of the two individuals comprising USNM 162645, as well as the contorted aspect of the specimen, suggest that it is the product of two separate fertilizations of independent ova sharing the same yolk. If true, then the two snakes are fraternal, not identical, twins. Vanzolini (1947) described a craniodichotomous Brazilian rattlesnake, *Crotalus durissus terrificus*, that exhibited similar contortions and ventral plate anomalies and for which he hypothesized that the condition arose from the "hypofusion of two embryonic areas." Klauber (1956: 199), referring to Vanzolini, discounted this possibility and maintained that the differences of lepidosis in amphidichotomous serpents were possible despite the fetuses' having arisen from a single zygote. Cunningham, (1937) however, presented a figure showing two independent embryonic discs developing on a single yolk of an egg of *Natrix natrix* (cited as *Tropidonotus natrix*). Because of the arrest of their development by preservation, however, it was not possible to state whether such a condition could have given rise to an amphidichotomous fetus. Carpenter and Yoshida (1967) described two sets of one-egg twins in a single clutch of nine eggs of *Agama agama*. While one egg contained two normal, well-developed embryos connected to a common yolk sac by separate umbilical cords, the other held a pair of embryos fused ventrally at the thorax. The condition of the umbilical cords was not stated for this second example.

Since Cunningham's study in 1937, there have been at least 39 additional cases reported for 30 different species of snakes in 63 literature citations. One specimen of a two-headed *Bothrops atrox* has been mentioned, described, or commented upon six times by four different authors, but most of the cranio- or anteriodichotomous serpents described during the past third of a century have been mentioned only once or twice, as befitting their negligible scientific status. During this same period, there have been but four reports of snakes exhibiting the rarer condition of posterior dichotomy and, with the exception of the present paper, only one mention of an amphidichotomous example. Below, we present a listing of two-headed, two-tailed, and Siamese-twin snakes mentioned in the literature since 1937. We have endeavored to trace each source cited and we apologize for any omissions. With the exception of the California kingsnake (see above), which attained a length of 31½ inches (800 mm) after six years in captivity (Shaw, 1959), all of the examples listed below represent new-born animals, fetuses, or embryos. This is in accordance with Curran and Kauffeld (1937), who state (p. 132) that "actual two-headed snakes are apparently not rare occurences in nature but few of these monstrosities survive to maturity...most of the records are of very young snakes or embryos, but a number of well developed individuals have been found."

In the following listing, a literature record which is known to be supported by a preserved individual available for examination is noted with an asterisk.

Cranio-and Anteriodichotomous Serpents: "Two-Headed Snakes" (1937-1970):

Family Colubridae

*Amphiesma vibakari**
Nakamura, 1938 (cited as *Natrix vibakari*)

*Dromicus chamissonis**
Pflaumer, 1945; Prado, 1946

*Elaphe climacophora**
Nakamura, 1938

*Elaphe conspicullata**
Nakamura, 1938

*Elaphe quatuorlineata sauromates**
Iki, 1946; Amrakh, 1949; Alekperov, 1954

*Helicops carinicauda infrataeniata**
Lema, 1958

*Heterodon platyrhinos platyrhinos**
Meyer, 1958

*Lampropeltis getulus californiae**
Shaw, 1956, 1959; Schmidt & Inger, 1957; Ludicke, 1964 (many photos exist)

*Lampropeltis triangulum triangulum**
Ludicke, 1964 (cited as *Lampropeltis doliata triangulum*)

*Leimadophis poecilogyrus**
Prado, 1942, 1943, 1946; Ludicke, 1964

*Leptodeira annulata ashmeadi**
Belluomini & Lancini, 1960

*Liophis miliaris**
Lema, 1957 (cited as *Liophis miliaris semiaureus*)

*Natrix natrix**
Martin d'Alte, 1937 (cited as *Tropidonotus natrix*); Themido, 1944 (cited as *Tropidonotus natrix*); Lüdicke, 1964; see also Ladeiro, 1935

*Natrix rhombifera rhombifera**
Oringderff, 1969 (cited as "snake"; identified from photograph)

*Philodryas patagoniensis**
Prado, 1946 (cited as *Philodryas schottii*)

*Regina septemvittata**
Neill, 1941 (cited as *Natrix septemvittata*)

*Regina septemvittata**
Goldberg, 1967 (cited as "garter snake"); Tuck, in press

*Rhabdophis tigrina**
Nakamura, 1938 (cited as *Natrix tigrina*)

*Tachymenis peruviana**
Lüer, 1944a, 1944b; Prado, 1946

Thamnophis sirtalis sirtalis
Cohen, 1937

*Xenodon merremi**
Belluomini, 1959

*Xenodon merremi**
Lema, 1961

Family Elapidae

*Pseudechis porphyriacus**
Longman, 1939

Family Viperidae

*Agkistrodon halys blomhoffi**
Nakamura, 1938

*Bothrops alternata**
Berst, 1945; Prado, 1946

*Bothrops atrox**
Daniel, 1941, 1955; Pflaumer, 1945; Prado, 1942, 1946; Lüdicke, 1964

*Bothrops atrox**
Dupouy, 1958

*Bothrops jararaca**
Pereira, 1950

*Bothrops jararacussu**
Pereira, 1944

*Crotalus durissus terrificus**
Vanzolini,,1947; Klauber, 1956; Ludicke, 1964

*Crotalus horridus horridus**
Rimkus, 1947, 1948 (cited as "rattler"); Klauber 1956

Crotalus horridus horridus
Anonymous, 1967 (cited as "rattlesnake"); Harris, 1968

*Vipera berus**
Nybelin, 1942; Curry-Lindahl, 1963

*Vipera berus**
Lagerlund & Hanstrom, 1961; Curry-Lindahl, 1963

*Vipera berus**
Steward, 1961

*Vipera russelli**
Deraniyagala, 1958

Posteriodichotomous Serpents: Snakes With One Head and Two Bodies or Two Tails (1937-1970):

Family Colubridae

*Natrix sipedon clarkii**
List & Smith, 1954

*Storeria dekayi**
Tripplehorn, 1955

*Thamnophis sirtalis sirtalis**
Martof, 1954

Family Elapidae

*Calliophis japonicus**
Nakamura, 1938 (cited as *Hemibungarus japonicus*)

Amphidichotomous Serpents: "Siamese-Twin" Snakes (1937-1970):

Family Colubridae

*Coluber constrictor constrictor**
Tuck & Hardy, this paper

Family Viperidae

Crotalus viridis viridis
Klauber. 1956

The authors wish to acknowledge the assistance of those who helped in the preparation of this paper. James A. Peters, Supervisor and Curator of the Division of Reptiles and Amphibians, United States National Museum of Natural History, placed Division facilities at the authors' disposal and read and criticized the manuscript. George R. Zug, Assistant Curator, Division of Reptiles and Amphibians, United States National Museum of Natural History, Ronald I. Crombie, and Pete Wemple read and commented upon parts of the manuscript and made useful suggestions. The x-ray was made by Fannie Phillips and printed by Daniel Lyons. Braulio R. Orejas-Miranda, Departamento de Zoologia, Museo Historia Natural, Montevideo, Uruguay, offered bibliographic and taxonomic suggestions, and Kay C. Ferris, Division of Mammals, United States National Museum, brought to the authors' attentions a pertinent newspaper article. We are especially indebted to L. Frances Jones, Chief, Acquisitions Division, Smithsonian Institution Libraries, for her help in our struggles with Russian texts and to Jack Marquardt, Assistant Chief, Reference and Circulation Division, Smithsonian Institution Libraries, for cheerful patience and diligence in obtaining for us obscure works and references.

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Division of Reptiles and Amphibians, United States National Museum of Natural History, Smithsonian Institution, Washington, D. C. 20560, and Natural Resources Institute, Chesapeake Biological Laboratory, University of Maryland, Solomons, Maryland 20688

Food of Larval Tailed Frogs

During the summer (1967), 50 larvae of the tailed frog, *Ascaphus truei,* were collected from 2 streams in northwestern Montana for the purpose of examining their gastro-intestinal tracts for food. Upon collection, 24 specimens were immediately killed and preserved (10 percent solution of formaldehyde) in order to stop the digestive processes and the others were returned alive and in separate containers to the Biological Station at Flathead Lake, University of Montana. The preserved larvae were measured and carefully dissected exposing the digestive structures. Each gastro-intestinal tract was removed and placed in a solution of FAA. After opening the gut, food samples were taken from the anterior, middle and posterior portion of the long intestine. Quantitative information concerning the percentage of food items was gathered by examining each sample with a compound microscope fitted with a ocular micrometer.

Results

According to Metter (1964), the larvae of the tailed frog, *Ascaphus truei,* feed on diatoms. Since this animal is especially adapted for existence in rapid-flowing streams, and since the most common algae found in these streams are diatoms, it seems reasonable to expect that the larvae of *Ascaphus* will feed primarily on this food material. The question came to mind while reading Metter's paper that if another food supply became available would there be a shift in diet. Several streams were examined but only two were found to contain large populations of larvae. In Coyle Creek, 3.4 miles NW of St. Regis, off Route 10, tributary of the St. Regis River, Mineral county, Montana, the population was found existing in a zone of small rapids; no algae were visible. In Ward Creek, 7.0 miles NW of St. Regis, off Route 10, tributary of the St. Regis River, Mineral County, Montana, the population was in a zone of rapid-flowing water (little or no rapids) containing heavy growths of *Spirogyra* and *Monostroma*. A series of 25 larvae were collected from each stream; 12 were preserved upon capture to prevent further digestion. These collections included first year to the practically transformed third year larvae.

Coyle Creek Population

The gastro-intestinal tracts of the preserved specimens from Coyle Creek were found to contain primarily diatoms. Scattered among the diatoms were

remains of several small aquatic fly larvae (Tendipedidae), a small quantity of Pinus pollen and bits of mineral matter. The most interesting substance that was found in the tracts was a mass of golden brown "pigment" resembling the coloring bodies in diatoms. Several complete but empty valves were associated with this pigment. No chemical test was used to determine the nature of the colored substance.

After a period of 24 hours, the material which collected in the bottom of the containers having the live material was examined. Since the plastic cartons were cleaned prior to establishing the larvae, it can be assumed that the material in the containers had passed through the digestive tract. Comparing the gut material of the preserved specimens with that of the waste found in the cartons, I found numerous empty diatom shells. It should be noted, however, that many diatoms passed through intact. An estimate was made on the percentage of broken cells and was found to be only 6 percent. According to Savage (1961), tadpoles must break these cells by the scarifying action of the cuticular teeth. Since there is no gastric mill, the larvae cannot break these cells open once they have passed into the digestive system.

Ward Creek Population

In Ward Creek, the population seemed to be concentrated around large rocks having dense growths of *Monostroma* and *Spirogyra*. The dissected preserved larvae contained mostly diatoms with a few strands of *Ulothrix*. Even though *Spirogyra* and *Monostroma* were common, none were found in the gut. The excrement of the live larvae contained only diatoms; approximately 5.5 percent of the diatoms in the faeces were empty.

To check this data five living larvae were placed in a plastic carton containing a pure culture of *Spirogyra*; another 5 in a carton containing *Monostroma* and a third group with *Ulothrix*. After 4 hours, the larvae were preserved, then the gastro-intestinal tracts and excrement were examined. No algae were found in the tracts and only mineral matter and a few diatoms were seen as faecal material in the containers.

Discussion

The larvae of the tailed frog were found to feed exclusively on diatoms. Occasionally other algae, some small insect larvae and mineral matter were secondarily ingested. Only the diatoms with ruptured walls appeared to be

acted on. Large clumps of golden brown material which probably represented the diatomaceous protoplasm and pigment were found. Even though other algae were abundant, the larvae apparently rejected these in favor of diatoms.

This information is part of a report that was submitted to Dr. G. W. Prescott as part of the requirements for a Phycology course, at the Biological Station, University of Montana.

Literature Cited

Metter, D. E. 1964. A morphological and ecological comparsion of two populations of the tailed frog, *Ascaphus truei* Stejneger. Copeia. No. 1, pp 181-195.

Savage, M. 1961. The ecology of the common frog. Pitman Press, London. pp. V-221.

—Richard Franz, *Department of Mammalogy, National History Society of Md., Inc. 2643 N. Charles St., Balto., Md. 21218.*

Additional Notes on the Feeding of Larval Giant Salamanders, *Dicamptodon ensatus*

In 1963, Metter listed caddisflies (order: Trichoptera) as a food item in the diet of larval giant salamanders, *Dicamptodon ensatus*. He found that the salamander larvae were consuming both adult and larval stages but did not mention whether the larvae were case-making or free-living caddisflies. On 10 August 1968, four larvae (total lengths - 142 to 172 mm.) of the giant salamander were netted from a pond near White Pass, Pierce County, Washington. Upon capture, these specimens were placed in a styro-foam ice chest. On the following day the chest was checked and was found to contain the four salamander larvae and seven empty stick cases of a pond-dwelling species of caddisfly (family Limnephilidae). Apparently the salamanders had ingested the trichopteran larvae and their cases and then excreted only the undigestable sclerotized portions of the larvae and the cases. The cases appeared to be unaffected after passing through the salamander's digestive tract. I returned to the same pond and found caddis larvae of the same case type on the underside of floating logs and boards. Ten individuals were

collected and placed in the ice chest. Immediately the largest giant salamander larva seized a caddis and ingested it. Within two hours, nine of the ten larvae and their cases were consumed. The next day nine empty cases were floating in the water in the ice chest indicating that, although the cases of these larval caddisflies are undigestable, they are still ingested by larval *Dicamptodon*. It is suspected that caddisfly larvae may be an important food source in this population.

Literature Cited

Metter, D. 1963. Stomach contents of Idaho larval Dicamptodon. *Copeia*, (2): 435-36.

—Richard Franz, *Dept. of Mammalogy, Natural History Society of Maryland, 2634 N. Charles Street, Baltimore, Maryland 21218.*

The Bog Turtle (*Clemmys muhlenbergi*) in Monroe County, Pennsylvania

Although disjunct populations of *Clemmys muhlenbergi* have been reported from New York to western North Carolina, there is a paucity of published accounts and museum records for the bog turtle in northeastern Pennsylvania. Barton and Price (1955) did not include Monroe County, Pennsylvania in their summarized knowledge of the known distribution of this species. Monroe County and the remainder of northeastern Pennsylvania are also excluded from the fragmented range of *C. muhlenbergi* as indicated by Conant (1958) and Nemuras (1967).

On 7 September 1966, Franklin B. Buser (personal communication) observed an adult bog turtle on the margin of Tannersville Bog Preserve, located 2 miles east of Tannersville, Monroe County. The mature sphagnaceous bog is characterized by a dense stand of mixed tamarack (*Larix laricina*) and black spruce (*Picea mariana*). A second Monroe County specimen was collected by Buser during the first week of July 1967, on Rt. 191, 0.2 miles N jct. Rt. 611. This locality falls immediately within the southern boundary of the borough of Stroudsburg. Development and reclamation of a small bog in the immediate vicinity may possibly explain the presence of *C. muhlenbergi* at this collection site. The male specimen had sustained a severe crack in the carapace, running

from the second vertebral to the distal end of the right fourth marginal. Shell pattern and conformity are otherwise normal and coloration is typical of the species. Measurement data include a striaght-line carapace length of 83.7 mm., a carapace width of 58.8 mm., and a height of 31.5 mm. The specimen is currently located in the author's private collection (JLB: 172).

The scattered and rather inaccessible bogs, swamps and wet meadows of Monroe County, Pennsylvania provide seemingly ideal habitat for the secretive bog turtle. Additional investigation should demonstrate that *C. muhlenbergi* is more abundant in northeastern Pennsylvania than records indicate.

Literature Cited

Barton, A. J., and John W. Price, Sr., 1955. Our knowledge of the bog turtle, *Clemmys muhlenbergi*, surveyed and augmented. *Copeia* 1955 (3): 159-165.

Conant, R. 1958. A field guide to reptiles and amphibians. Houghton Mifflin Company, Boston. 366p.

Nemuras, K. T. 1967. Notes on the natural history of *Clemmys muhlenbergi*. Bull. Maryland Herp. Soc. 3(4): 80-96.

—John L. Behler, *Department of Biology, Hobart* and *William Smith Colleges, Geneva, New York 14456.*

Additional Notes on the Coeur D'Alene Salamander, *Plethodon vandykei idahoensis*, in Montana

In August 1962, Teberg (1964) collected one adult female and two juveniles of the Coeur D'Alene Salamander, *Plethodon vandykei idahoensis*, in northwestern Montana. The female was found under a flat rock in the splash zone of a small brooklet, eleven miles south of Libby, Lincoln County; the juveniles, from a saturated rock talus at the base of a cliff, 5.5 miles southeast of Troy, Lincoln County. The water at both localities drained into the Kootenai River. These specimens represented the first plethodontid salamanders to be

reported from Montana. Later a third locality for this species was found at Cascade Creek, 6.5 miles south of Paradise, Mineral County (Clark Fork drainage) by Teberg.

Fig. 1. Adult Coeur D'Alene Salamander from rock face near Troy, Lincoln County, Montana. (photograph by Robert Simmons).

On June 26, 1966, I visited the second locality, an extensive cliff extending for several hundred yards along U.S. Route 2. Most of the cliff area was hot and dry but at two points small streams flowed over the vertical face forming two very active weeps. Small talus cones had formed at the base of each weep. The larger of these areas was twelve feet wide and twenty-five feet high. Moss, *Philonotis*, blanked all but the steepest surfaces of the weeps. Liverworts, *Marchantia*, and monkey flowers, *Mimulus*, grew in profusion in the moss on the face and in the talus. A variety of horse-tail, *Equisetum*, was abundant along the roadside gutter which funnelled water from the weep into a pipe which ran under the road. On this date I collected five juvenile *Plethodons* (24 to 32 mm./total length) from the large

weep and one from the smaller area (28 mm /total length). These specimens were found in small depressions in the saturated soil under rock chips at the base of the cliff. None were seen in the talus or on the cliff face. I returned on June 30, 1967 with Dawn Allen and Joe Elliott (students at the Biological Station, University of Montana) to this locality. After examining the rocks and talus at the base of the weep, mats of moss were turned and three adults were captured (Table). Specimens are now in the collections of Dr. Orr at Kent State University, Dr. Pettus at Colorado State University (Fort Collins), and the Natural History Society of Maryland. On July 14, 1967 the area was revisited but this time after dark (11 PM) and to my surprise, seventeen adults were found in the open on the face of the larger weep. Eleven of them were sitting in small cracks with their heads and one third of their bodies exposed. When the light from the head lamp was trained on them, they retreated into the crevices. The habits and behaviour of these specimens were reminiscent of cliff-dwelling populations of dusky salamanders, *Desmognathus*, in western Maryland. The other salamanders were found wandering over the moss apparently actively foraging. One individual on the moss caught and consumed a small aquatic earthworm while I watched. No juveniles were seen at this time.

Total length	Body length	Costal Groove Count
59.4 mm.	35.5 mm.	15
57.1	33.7	15
44.4	25.0	15

Table. Size and costal groove count of three adult Coeur D'Alene Salamanders from rock face near Troy, Lincoln County, Montana.

Literature Cited

Teberg, E. Kenneth 1964. An extension into Montana of the known range of the salamander, *Plethodon vandykei idahoensis*. Herpetologica Vol. 19, No. 4, p. 287.

—Richard Franz, *Dept. of Mammalogy, Natural History Society of Maryland 2634 N. Charles Street, Baltimore, Maryland 21218*

A Record Size for the Northern Brown Snake, *Storeria dekayi dekayi*

Conant (1958) reported the record size for the northern brown snake, *Storeria dekayi dekayi* as 18 3/8 inches. In May 1966, a female of this subspecies was collected by Mark Welch in a vacant lot near the 900 block of Dartmouth Avenue, Baltimore, Maryland. This specimen measured 19 3/8 inches and exceeds Conant's record length by one inch. The specimen is preserved in the Carnegie Museum (CM-43524).

Literature Cited

Conant, Roger 1958. A field guide to reptiles and amphibians. Houghton Mifflin Company. 366p.

—John D. Groves, *Reptile House, Baltimore Zoo, Baltimore, Maryland 21217*

A Note on the Feeding Habits of *Micrurus fulvius fulvius*

A 30 inch *Micrurus fulvius fulvius* was collected during April 1969, under palmetto leaves (11:00 am) in Buleah Ruins State Park, approximately 10 mi. W. Daytona Beach, Volusia County, Florida. Disection revealed that an 8 inch *Micrurus* had been eaten prior to capture. Ophiophagy is well documented in the literature for this species, but published records of *Micrurus* feeding on its own species are rare. Both specimens are preserved in the Biology Laboratory of Parkville Senior High School.

—Bob Chance, *Parkville Senior High, 2600 Putty Hill Avenue, Baltimore, Maryland 21234*

Predation by Reptiles on the Periodic Cicada

During their brief period of emergence, periodic cicadas became available as food items for many animals. The following two instances report the ingestion of the seventeen-year cicada by two species of reptiles.

On 30 May 1970, a 900 mm *Agkistrodon contortrix mokasen* which had recently been shot was found dead on a rock wall near Charlestown, Jefferson County, West Virginia. During examination, a cicada nymph was noticed, partially exposed by one of the gunshot wounds. Disection revealed 18 nymphs and one adult (recently transformed from the nymph). This specimen along with its stomach contents is preserved in the Natural History Society of Maryland collection. McCauley (1945) mentions notes from Father McClellan's diaries recording periodic cicadas being ingested by *Agkistrodon c. mokasen*.

A 186 mm *clemmys insculpta* was found dead in an abandoned resvoir located off Charles Street near the Sheppard-Pratt Hospital, Baltimore County, Maryland on 19 June 1970. It was disected and found to contain nine eggs and numerous cicada parts. Although the stomach contents were too digested to determine specific numbers we would estimate that between five and seven nymphs were present.

These observations, though not extensive, tend to indicate that the feeding habits of some reptiles are flexible enough to take advantage of the periodic abundance of food items not normally available.

Literature Cited

McCauley, R. H. 1945. The reptiles of Maryland and the District of Columbia. Hagerstown, Maryland.

—Mike Reid and Ash Nichols, *151 Stanmore Road and 121 Marburth Avenue, Baltimore, Maryland*

Carpenter Frog, *Rana virgatipes*, on the Coastal Plain of Maryland

The carpenter frog, a "coastal plain endemic," as Conant (Maryland. A Journal of Natural History, 17: 72-73, 1947) refers to it, has been reported from Maryland only three times, so far as this writer has been able to ascertain.

Conant (*loc. cit.*) reported the first Maryland specimen of this species from near the edge of Blackwater Wildlife Refuge, in southern Dorchester County, April 10, 1947. A second record was made by William Pruitt and the writer while camping in the Pocomoke Swamp, approximately 100 yards below the Delaware state line, on the night of June 12, 1948. The habitat at this station in the Pocomoke was a sphagnum bog on the upland side of the swamp. Throughout the night it was the only creature heard.

A single carpenter frog was heard by Catesby Jones and the writer in the vicinity of Blackwater Refuge, on November 20, 1948. This late date constitutes the third record for the State.

It may be of interest to note that Robert Stewart and the writer procured six of these frogs in a burned-over section of the Pocomoke Swamp half a mile north of the Maryland state line in Delaware, on the night of April 20, 1948. This location lies between the towns of Selbyville and Gumboro, Delaware.

A southern species; this is but one of a number of Austroriparian animals and plants that occur in the Pocomoke Swamp. Some other examples are Swainson's Warbler (*Limnothlypis swainsonii*), Red Bay (*Persia borbonia*), Horse Sugar (*Symplocos tinctoria*), Cross-vine (*Bignonia capreolata*), and Bald Cypress (*Taxodium Distichum*).

Brooke Meanley

Reprinted from Proc Biol. Soc. Wash., 64: 59.

Eumeces laticeps (Schneider) in the Alleghanian Zone of Maryland

Published records for the occurrence of *Eumeces laticeps* in Maryland list this species principally from the Coastal Plain province.

It is known to occur in St. Mary's County in southern Maryland, and at various points east of the Chesapeake Bay, on the "Eastern Shore," where the writer, accompanied by John Hamlet, has seen as many as ten (10) individuals of the species in a day, near Centerville. Its habitat at this locality was composed mainly of an oak-beech overstory, with a scattering of laurel and blueberry in the shrub stratum. Scattered throughout the woods were a number of dead chestnut stumps and windfalls in which the reptile lived.

Recently, J. A. Fowler (Proc. Biol. Soc. Washington, 59: 165, 1946) reported the occurrence of *Eumeces laticeps* on the Piedmont Plateau, 2½ miles above Seneca, in Montgomery County.

The known range of the species can now be extended westward, into the Blue Ridge, where it is probably fairly common.

On May 23, 1948, the writer, accompanied by Maurice and Jack Zardus and Paul Anderson, captured a specimen at the top of Sugar Loaf Mountain, an outlier of the Catoctin Mountains, in Frederick County.

Approximately a year later, May 15, 1949, the same party observed two of these large skinks on Elk Ridge at Weverton (near Harper's Ferry, W. Va.), Washington County, Maryland.

So far as the writer is able to learn, these are the first records for *Eumeces laticeps* from the Alleghanian Zone of Maryland.

Brooke Meanley

Reprinted from Proc. Biol. Soc. Wash., 64: 59-60.

Natrix erythrogaster in the Austroparian Zone of Maryland

McCauley, in his "Reptiles of Maryland and the District of Columbia," gives only two locality records of *Natrix erythrogaster* from Maryland. Both records are from the upper Pocomoke Swamp, a region where this southern snake might be expected to occur, since the Pocomoke is a tongue of Austroriparian element that extends northward through the central-eastern part of the "Del-Mar-Va: Peninsula. The

capture by the writer of a large specimen two miles north of Powellville, Maryland, along the Pocomoke River, on April 2, 1950, constitutes a third record for Maryland. The habitat here was a partly drained cypress-gum stand, in which several of the cypress trees measured three feet in diameter.

Brooke Meanley

Reprinted from Proc. Biol. Soc. Wash., 64: 60.

THE COAL SKINK, *EUMECES ANTHRACINUS* (BAIRD), IN MARYLAND.—The coal skink has previously been recorded from Maryland on the basis of three specimens, two of which, labeled "Allegany County, Maryland," are deposited in the collection at the Academy of Natural Sciences of Philadelphia. The other, labeled "Mt. City Gap, Maryland," is in the collection at Cornell University (Taylor, 1935, Univ. Kansas Sci. Bull., 23: 386). McCauley (1940, Copeia (1): 50) has shown that the latter record is actually from Georgia. He (1945, The reptiles of Maryland and the District of Columbia: 41-42) has also indicated that this species "should be looked for further in suitable localities anywhere from the Blue Ridge west upon the Alleghany Plateau. I consider it especially likely to occur in the swamps and glades of Garrett County."

Recently, specimens have been collected on the Alleghany Plateau, as predicted by McCauley, which more definitely establishes *anthracinus* as indigenous to the herpetofauna of Maryland. A female (NHSM-R 1297), measuring 59 mm. (snout to vent), was collected at Swallow Falls State Park, Garrett County, Maryland, on May 29, 1949, by Robert Lambert and Anthony Marsiglia. This individual, which contained seven eggs, was discovered beneath a large rock covering a small pool of water. Previously, on September 5, 1948, in the same area, the senior author had observed a specimen under a slab of wood on a small mound surrounded by moss.

On September 3, 1949, this area was revisited by the authors, and two additional *anthracinus* were captured. The first (NHSM-R 1578), a young specimen measuring 26 mm. (snout to vent), was discovered in a sandy rockpile beneath a small rock which was imbedded in moss. The second (NHSM-R 1579), which measured 56 mm. (snout to vent), was found in a similar situation.

Generally speaking, the area in which these skinks were discovered is boggy, with moss the predominating vegetation. This bog, extending over an area slightly less than an acre, is underlain with small pools and streams; stones and pieces of wood are abundant and a dirt road bordered by trees runs through its center.

Other species of reptiles and amphibians collected in this area were: *Haldea v. valeriae, Diadophis p. edwardsi, Opheodrys v. vernalis, Elaphe o. obsoleta, Lampropeltis triangulum, Natrix s. sipedon, Storeria o. occipitomaculata, Thamnophis o. ordinatus, Crotalus h. horridus,* and *Hemidactylium scutatum.*

The writers are indebted to Romeo Mansueti, biologist, Maryland Department of Research and Education, Solomons, Maryland; Mr. John Cooper and Joseph Gentile, Natural History Society of Maryland; and especially to Mr. James A. Fowler, Director of Education, The Academy of Natural Sciences of Philadelphia.—Leo Lemay and Anthony G. Marsiglia, *Natural History Society of Maryland, 2101 Bolton Street, Baltimore 17, Maryland.*

Reprinted from Copeia, 1952 (3): 193

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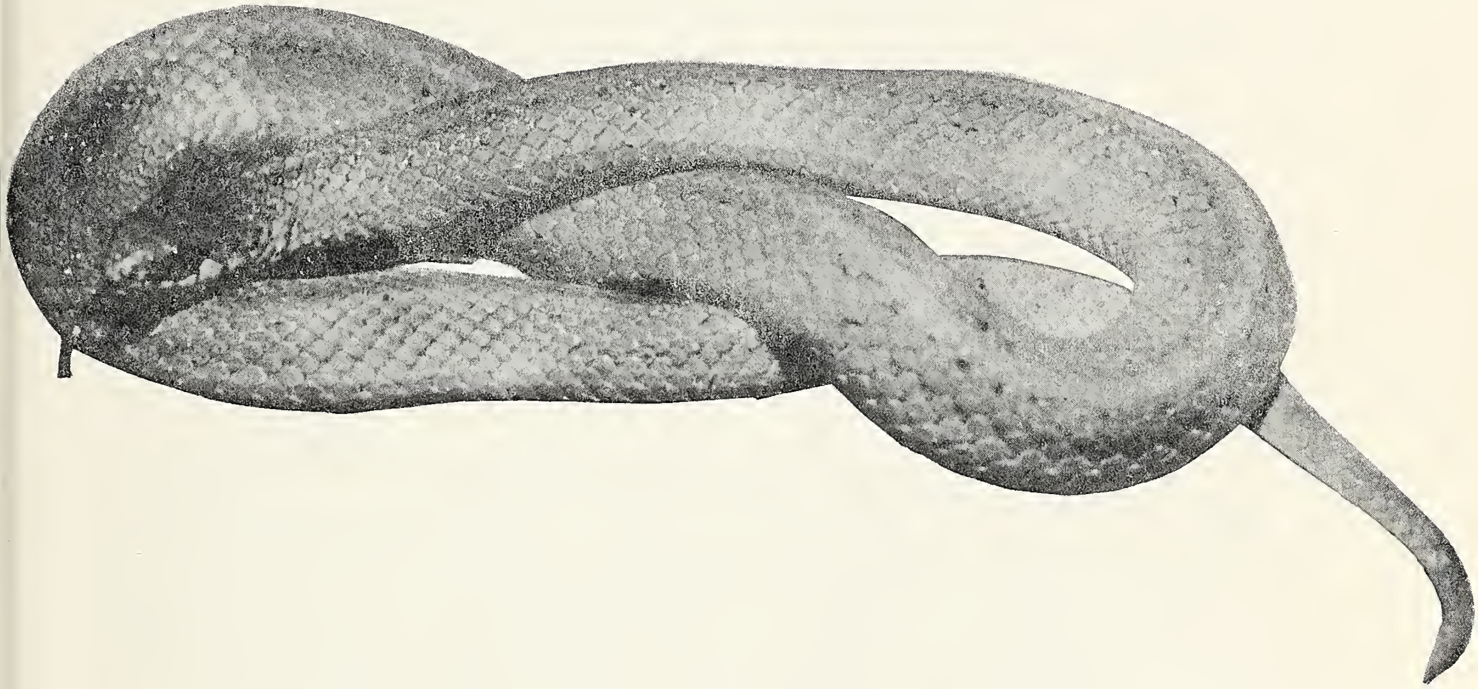
BULLETIN OF THE

Maryland Herpetological Society

The Natural History Society of Maryland, Inc.



DECEMBER 1970 VOLUME 6, NUMBER 4

Bulletin of the Maryland Herpetological Society

Volume 6 Number 4 December 1970

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Library of Congress Catalog Card Number: 76-93458

The Cover: An adult *Virginia valeriae pulchra* from near Swallow Falls State Park, Garrett Co., Maryland. Photography by Dr. R. S. Simmons.

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The Maryland Herpetological Society, Department of Herpetology, Natural History Society of Maryland, Inc., 2643 North Charles Street, Baltimore, Maryland 21218

BULLETIN OF THE

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Volume 6 Number 4 December 1970

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THE ECOLOGICAL AND BIOGEORGRAPHICAL DISTRIBUTION OF THE TAILED FROG, *ASCAPHUS TRUEI*, IN THE FLATHEAD RIVER DRAINAGE OF NORTHWESTERN MONTANA

Richard Franz
and
David S. Lee

Throughout much of its range the distribution of the tailed frog, *Ascaphus truei*, appears to be sporatic. The Flathead River in northwestern Montana is no exception. Between the summers of 1966 and 1969 an attempt was made to interpret the effect of present ecological factors and past biogeographic undulations on the distributional patterns of this primitive amphibian in this area.

Previous authors, Brunson and Demare (1951), Rodgers and Jellison (1942), and Manville (1957), mentioned locality records for *Ascaphus* in Montana; Manville (1957) included records for tailed-frogs from within our study area (Lake McDonald to Lake Evangeline, Glacier National Park). These authors made no attempt to evaluate the distribution of *Ascaphus* in Montana.

GENERAL DESCRIPTION OF STUDY AREA

The Flathead River in northwestern Montana is a major tributary of the Clark Fork of the Columbia River. It discharges more than 120,000,000 cu. meters of water annually and drains an area of approximately 9000 sq. miles. Within this area there is a wealth of diverse aquatic situations including warm and cold streams, large rivers, sloughs, acid bogs, deep glacial lakes and glaciers. The headwaters are at an elevation of over 10,000 feet, and its mouth at approximately 2000 feet (a drop of almost 8000 feet over the length of the river). Eight major drainage systems contribute water to the Flathead (Fig. 1.) These are the North Fork, Middle Fork, South Fork, Stillwater, Whitefish, Swan, Little Bitterroot and Jocko Rivers. This area will be discussed in more detail in a forthcoming paper (Franz, in press).

METHODS

The larvae of *Ascaphus truei* are usually easier to observe than the adults; and this stage in the life history of the frog is more demanding in its ecological requirements. Because of these factors, stream samples were usually concerned with determining the presence or absence of tadpoles. Numerous techniques were employed in collecting the larvae. The most practical involved placing a seine or large dip net down-stream from the area that was to be worked for *Ascaphus*

Swan River drainage

Flathead County

*Wolf Creek	1	3200 feet
*Bear Creek	2	3750
*Peterson Creek	3	4000
Peterson Creek	4	3100
Patterson Creek	5	3250
Johnson Creek	6	3275

Lake County

*Six Mile Creek	7	3275
How Creek	8	3300
Hall Creek	9	3375
Groom Creek	10	3375
Bond Creek	11	3375
Lost Creek	12	3400
Soup Creek	13	3350
Squaw Creek	14	3475
Goat Creek	15	3400
Pony Creek	16	3775
Dog Creek	17	3775
Condon Creek	18	3750
Yew Creek	19	3350
Swan River	20	3100
Woodward Creek	21	3600
Fatty Creek	22	5300
Cedar Creek	23	3450

Missoula County

Cooney Creek	24	4000
Rumble Creek	25	3750
Holland Creek	26	3900
Glacier Creek	27	4800
*Herrick Run	28	5100
Meadow Lake Creek	29	5600
Barber Creek	30	4050
*Owl Creek	31	4175

South Fork of Flathead

Flathead County

*Emery Creek	32	3900
*Tiger Creek	33	4100
*Dudley Creek	34	4400
*Devils Corkscrew	35	4025
Lower Twin Creek	36	4000
*Soldier Creek	37	4050
*Clark Creek	38	4175
*Forest Creek	39	4075
*Graves Creek	40	4050
*Ben Creek	41	3600
*Clayton Creek	42	3700
*Wounded Buck Creek	43	3600
*Doris Creek	44	3575
Aeneus Creek	72	6300

*refers to streams containing populations of tailed frogs.

Middle Fork of Flathead

Flathead County

*Kootenai Creek	45	3700 feet
Deer Lick Creek	46	3650
Stanton Creek	47	3900
Tunnel Creek	48	4000
Dickey Creek	49	4725
Essex Creek	50	4000
Bear Creek	51	4100
*Bear Creek	52	5125
*Skyland Creek	53	5300
*Sperry Creek	54	6000

North Fork of Flathead

Flathead County

*Dutch Creek	55	4200
*Sprague Creek	74	6000

Upper Flathead River

Flathead County

Flathead River	56	3500
Ashley Creek	57	3000
Ashley Creek	58	3800

Stillwater River drainage

Flathead County

Logan Creek	59	3400
Stillwater River	60	3000
Stillwater River	61	3100
Spring Creek	62	4050
	63	3500

Lower Flathead River

Sanders County

near Perma	65	2600
near Dixon	66	2675

Lake County

*Mission Creek	67	2900

Jocko River drainage

Sanders County

Jocko River	68	2650

Flathead Lake Area

Lake County

*Teepee Creek	69	3000
Crane Creek	70	3000
Hunger Creek	71	3000

Little Bitterroot River drainage

Flathead County

Camas Hot Springs	64	2800
Bitterroot Creek	73	3000

Figure 1. MAP OF FLATHEAD DRAINAGE SHOWING STREAMS WHICH WERE SAMPLED.

larvae. Collectors then moved rocks with entrenching tools and raked the gravel with cultivators. Occasionally adults were collected in the same manner, but searching at night along stream flood plains proved more successful.

Certain streams were investigated chemically and thermally. The following chemical methods were employed:

1. Dissolved oxygen concentration-modified Winkler method using manganous sulfate, alkaline iodide sodium azide, conc. sulfuric acid; titrate with N/40 sodium thiosulfate.

2. Carbon dioxide concentration-(as carbonic acid) add 10 drops of phenolphthalein to 100 cc. of water; if no color develops, titrate with N/44 sodium hydroxide to pink, multiply the amount of sodium hydroxide used by 10.

3. Carbonates-(phenolphthalein alkalinity) add 4 drops of phenolphthalein; if pink color develops, titrate with N/50 sulfuric acid till color disappears; multiply the amount of sulfuric acid used by two then by ten (2P x 10 = carbonates).

4. Bicarbonates-(methyl orange alkalinity) add 4 drops of methyl orange; titrate with N/50 sulfuric acid until color changes from orange to salmon pink; subtract 2P from the total amount of sulfuric acid used and then multiply by ten (T - 2P x 10 bicarbonates).

5. Hydrogen ion concentration- colorimetric method using indicators. Elevations were calculated with Lufft altimeter (No.64703). Temperatures were measured to the nearest 1°C. Aquatic insects were identified by the authors and verified by Dr. Arden Gaufin. Plants were identified by Dr. John Thomas and Dr. Gerald Prescott.

ECOLOGICAL ASPECTS OF THE DISTRIBUTION OF *ASCAPHUS*

Several environmental considerations appear to provide major limiting factors for the distribution of *Ascaphus*. Climate, elevation, water chemistry, water temperature and stream gradient (and thus depth), all appear to be interrelated factors which dictate patterns of distribution in tailed frogs. We will also discuss the terrestrial landscape surrounding streams of the Flathead River drainage and aquatic plants and animals associated with *Ascaphus* and non-*Ascaphus* streams although no qualitative data is available as to the importance of these items on frog populations. More likely these simply represent flora and fauna with corresponding ecological tolerances and are here considered as index species. Similar ecological considerations were discussed by Metter (1964) in habitats in northern Idaho.

ABIOTIC ENVIRONMENT

Ascaphus larvae show a marked preference for small (Fig. 2) fast streams under 14 feet in width. (Table 1). It appears that rocky bottomed streams, with little aquatic vegetation are preferred. Streams with large slabby-flat bottomed rocks support higher concentrations of *Ascaphus* larvae than do those with smaller irregular, smooth edged, round rocks. Sandy, gravel or organic bottomed streams do not support populations of this amphibian.

Figure 2. WOLF CREEK, A TYPICAL *ASCAPHUS TRUEI* STREAM.

Water chemistry tests were conducted on 9 streams in our study during the summer of 1969. Data gathered from these tests indicate a strong correlation between certain physical properties of the water and the presence of *Ascaphus* larvae (see Table 2). Often streams with low methyl orange alkalinity and no phenolphthalein alkalinity support populations of *Ascaphus*; pH likewise seems to influence the presence of tailed frog larvae, for streams with pH readings above 7.7 were found not to contain tadpoles of these frogs. Free CO_2, in itself, may have little influence on *Ascaphus* and more likely concentrations are dictated by the previously mentioned water properties. Dissolved oxygen retained by cold running water (7.5-10.5^{o}C) appears to be a major limiting factor for *Ascaphus* distribution in the twelve sample sites.

Field data strongly implies that tadpoles of the tailed frog can not survive at temperatures above 16^{o} C. In Wolf Creek, Flathead County, larvae were found at temperatures of 7.5^{o} C. Under laboratory conditions, larvae were active at temperatures as low as 1 - 2^{o} C. In harsh environments (i.e. stream headwaters near glaciers and permanent snow fields) the survival value of this ability is obvious. We believe the adults can tolerate slightly higher temperatures.

Elevation readings taken at 74 sampling sites in the Swan, Stillwater, Flathead (three major forks), Little Bitterroot and Jocko River systems indicate that altitude is a factor in distribution of the tailed frog. Four of six (66.6%) streams sampled between 5000 and 6000 feet and nine of 18 (50%) between 4000 and 5000 feet

supported populations of *Ascaphus* larvae. Only ten of forty one (24.4%) streams between 3000 and 4000 feet contained this amphibian and no streams below 3000 feet were found to be populated. Although it would appear that elevation is an important limiting factor in the distribution of *Ascaphus* it is probably more indicative of the stream gradient provided by the elevation of this particular area. Likewise the respective plant communities bordering the stream would be important to *Ascaphus* distribution and these are markedly dictated by elevation.

The following information on climate is modified from Habeck (1967). The climate of the Flathead area is controlled by cool, moist air masses which penetrate into the area from the Pacific Ocean. The air looses much of the original moisture in ascending the Cascade and Coastal Ranges of western Washington and British Columbia however considerable amounts of moisture is retained and carried inland.

Precipitation is not uniform in northwestern Montana. As the moist air enters the area it is forced to rise by the Bitterroot Range. Here much of the moisture is lost causing arid conditions (less than 15 inches at elevations under 3000 feet) east of the range. This rainshadow extents into the Flathead area as far east as the western front of the Mission and Swan Ranges. Again the air is forced to rise and the amount of precipitation increases. Moist air coming into Montana from the extreme northwest is not stopped by the lower Purcell and Flathead Mountains hence penetrates as far east as Glacier National Park in the northern portion of the Flathead area. The western portion of Glacier National Park below 3500 feet receives about 25 to 30 inches annually and 80 to 100 inches at higher elevations. Much of this precipitation at high elevations is snow and it is not uncommon to have accumulations of 100 to 200 inches above 6500 feet.

In the Flathead area, summers are cool and it is not uncommon to have temperatures below 32° F at any time at the higher elevations. At Flathead Lake the night temperatures are frequently below 50°F but the days may get into the low 80's. Winters are cold. A few miles south of the area the coldest temperature ever recorded (-70°F) in the continental United States was reported. Apparently the large Flathead Lake keeps its valley warmer in the winter and cooler in the summer.

BIOTIC ENVIRONMENT

Detailed attention was given to both the terrestrial and aquatic plants of *Ascaphus* streams. Table 3 illustrates typical flora associated with an *Ascaphus* stream (Soldiers Creek). Two dominant overstory plants, the dogwood *Cornus stolonifera*, and the alder *Alnus incana*, appear important in that their shading effect maintains high humidity and low temperatures. It should be pointed out that shading in itself is not a critical factor for *Ascaphus* larvae. It is only necessary for the major portion of the stream to be protected from the sun's rays in order for low water temperature to be maintained. *Ascaphus* larvae will live

in sunlit as well as shaded portions of the stream. We will not attempt to speculate on the importance of other vegetation scattered along this stream. In other *Ascaphus* streams the dominant overstory is provided by western or red cedar, *Thuja plicata*; hemlock, *Tsuga heterophylla;* and western larch, *Larix occidentalis*.

Streams lacking dense overstory, either because of location (i.e. grasslands, sagebrush desert, Ponderosa Pine ecotones, wet meadows, river flood plains) or because water courses are too wide to allow the canopy to extend significantly over the stream banks, do not contain *Ascaphus* populations.

In cold, fast, shaded streams diatoms, *Spirogyra, Ulothrix, Monostroma* and similar aquatic plants were found. Various species of *Potamogeton, ceratophyllum,* and *Myriophyllum* are characteristic of non-*Ascaphus* streams.

Likewise the insect fauna of streams containing larval *Ascaphus* are quite different from those which do not have them. *Ascaphus* streams can often be recognized by a large number of immature insects which serve as indicators: mayflies (of the genera *Iron, Rhithrogenia, Heptogenia*); stoneflies (*Peltoperla, Isogenus, Acroneuria*); caddisflies (*Glossosoma, Rhyacophilia* 6 species, *Parapsyche* 2 species *Arctopsyche, Brachycentrus*); dipterans *(Blepharicera, Atherix)*. In streams uninhabited by *Ascaphus* there are other insects. Some which are usually not encountered in *Ascaphus* habitats: mayflies (*Ephemera, Hexagenia*); dragonflies (*Ophiogomphus, Agrion*); stoneflies (*Pteronarcys*); true bugs (*Gerris*); caddisflies (*Wormaldia, Glossosoma, Arctopsyche, Hydropsyche* 3 species, *Cheumatopsyche, Brachycentrus, Helicopsyche*); beetles (*Agabus*); dipterans (*Hexotoma, Tipula*). It is interesting to note that only 3 genera are found in both types of streams (*Glossosoma, Arctopsyche, Brachycentrus*). With the exception of *Arctopsyche (grandis)* it would appear that different species of these genera were encountered in each stream type.

SPECULATIVE BIOGEOGRAPHIC HISTORY

During the last major glacial period, most of the study area was covered by either glacial ice of the Cordelleran Ice Sheet or by the waters of Lake Missoula (2000 feet deep).

During this time two areas, one in the lower Mission Mountains and the other in the Salish Mountains possibly acted as refugia for *Ascaphus*. After the glacial retreats, the species using the cold, rapid-flowing melt water spread. The frog migrated up the North, Middle and South Forks of the Flathead River. Large nunataks also may have been retreats for small populations. As evidence of this, the caddisfly *Rhyacophilia unimaculata* has been found near Mt. Robson, British Columbia, several hundred miles north of the former southern edges of the Cordelleran Ice Sheet and Ross (1956) speculates that this cold, swift stream habitat persisted during glaciation on unglaciated peaks arising above the ice fields. As pointed out earlier, species of *Rhyacophilia* are abundant in *Ascaphus* streams today, and we can imagine that populations of this frog used similar survival methods.

Presently, *Ascaphus* inhabit only one of the two possible refugia-the lower Mission Mountains. Authorities agree that after the final major glacier retreated approximately 10,000 years ago there was a warming and drying period in the Flathead region. The maximum warmth and drought reached a peak between 4500 and 6500 years ago. This apparently caused the complete melting of all of the isolated valley glaciers and caused many streams to become intermittent. A period of extinction followed. The species disappeared completely from the Salish Mountains, the northern Missions and the lower elevations in the various valleys of the major tributaries. Essentially each stream supported an isolated population and probably the gene exchange was very slight between these colonies.

About 4000 years ago another climatic change occurred permitting the reappearance of small mountain glaciers. The glaciers fluctuated in size but never attained the magnitude of the Pleistocene glaciers. Besides a slight cooling there was probably an increase in precipitation. The drainage pattern began to take on the appearance it has today. The populations were able to mingle particularly in the valleys of the North, Middle and South Forks of the Flathead River. Since the lower Stillwater River remained deep and slow moving, the species never managed to use this as a dispersal route into the northern Salish Mountains. The Flathead Lake probably acted in keeping the frogs from migrating into the northern Missions and Salish Mountains near the Lake. Today the populations in the lower Missions are still isolated because the streams flow out of the mountain valleys onto the gravel floor of old Lake Missioula. The streams became warm and lost their velocity. A similar situation occurs in the Little Bitterroot and in many of the small streams which flow into the lower Flathead River.

SUMMARY

We have presented possible ecological and geographical explanations for current sporatic distribution patterns of *Ascaphus truei* in the Flathead River drainage of northwestern Montana. Water temperature is probably the single most important factor limiting the distribution of this frog. Many additional, and often secondary, aspects are discussed. Modern environmental conditions do not appear to be the only factors involved in this complex situation; many streams which seem ecologically acceptable for *Ascaphus* are not inhabited. This latter problem is best explained by past biogeographical undulations which are theorized above.

	Total No. of Streams Examined	No. of Streams with *Ascaphus*
I Cold Water Streams (temperature under 16° C)	46	26
A. Small (under 8 ft. in width)	31	18
1. slow	8	1
2. fast	23	17
B. Medium (between 8 and 14 ft.)	11	8
1. slow	2	0
2. fast	9	8
C. Large (over 14 ft. in width)	4	0
1. slow	0	0
2. fast	4	0
II Warm Water Streams (temperature over 16° C)	28	0
A. Small (under 8 ft. in width)	13	0
1. slow	4	0
2. fast	9	0
B. Medium (between 8 and 14 ft.)	9	0
1. slow	2	0
2. fast	7	0
C. Large (over 14 ft. in width)	6	0
1. slow	0	0
2. fast	6	0

Table 1. The distribution of *Ascaphus truei* in 74 streams of the Flathead River drainage, northwestern Montana.

Locality	temp. ^{o}C.	CO_2	Oxygen	pH	methyl or. alkal.	phenol. alkal.
*Wolf Cr.	7.5	1	8.5	7.7	60	0
*Bear Cr.	9.5	3	8.2	7.2	41	0
*Peterson Cr. (4000 ft.)	8.5	2	8.8	6.4	48	0
Peterson Cr. (3100 ft.)	20.0	7	7.4	7.4	84	0
*Six Mile Cr.	10.5	2	8.5	6.8	40	0
Johnson Cr.	17.0	2	8.0	7.4	96	0
Patterson Cr.	14.0	3	7.0	7.6	68	0
Swan River	17.0	0	7.2	8.4	105	5
Mud Cr.	17.0	0	9.5	8.4	145	5
Ashley Cr. (3650 ft.)	23.0	0	10.0	8.8	204	19
Ashley Cr. (3800 ft.)	23.0	0	6.2	8.2	208	18
Ashley Cr. (3000 ft.)	22.0	0	5.0	8.4	200	10

Table 2. List of water chemistry test conducted on several streams in the Flathead drainage. * indicates the presence of the tailed-frog, *Ascaphus truei*. (Test conducted June 29 through July 5, 1969.)

Vegetation	Adjacent Forest	Over Story	Under Story	Open Areas	Emergent on stream gravel	Submergent
Angiosperms						
Dicotyledons						
Cornus stolonifera		X				
Alnus incana		X				
Heracleum lanatum			X	X		
Symphoricarpos albus			X	X		
Lonicera involucrata			X			
Mimulus guttatus					X	X
Veronica americana					X	
Galium sp.			X		X	
Senecio triangularis				X		
Acer rubrum		X				
Trifolium sp.				X		
Ribes sp.			X			
Monocotyledons						
Streptopus amplexifolius				X		
Elymus sp.			X	X		
Phleum sp.			X			
Gymnosperms						
Pinus contorta	X					
Pteridophytes						
Pteridium sp.			X	X		
Equisetum				X	X	
Woodsia sp.			X			
Bryophytes						
Brachythecium					X	X
Minium					X	X
Marchantia					X	X
Conocephalium					X	X
Algae						
Ulothrix						X
Various diatoms						X

Table 3. A list of the plants observed in Soldier Creek Area, South Fork of Flathead River, with an indication to their habitat. In other *Ascaphus* streams, *Thuja plicata*, *Tsuga heterpphylla*, and *Larix occidentalis* are common.

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A LIST OF THE AMPHIBIANS AND REPTILES OF FLORIDA

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The following is a list of the amphibians and reptiles known to me that have been reported from the state of Florida. Several previous lists of Floridian herpetofauna that have been published have since become outdated because of taxonomic changes and the discovery of additional forms in the state. I have found it difficult to keep up with the seemingly endless taxonomic revisions of American herpetofauna. Numerous changes have undoubtedly occurred, of which I am not aware. In cases which I have been aware of a subspecific name being suppressed I have adjusted the list accordingly.

The common names, unlike their counterparts, have remained suprisingly constant. In a few cases, species and races have been recently described and the authors failed to suggest any common name. I have been so bold as to suggest names for these animals. In addition I have altered the established common name of one salamander (*Haideotriton*) in view of new biogeographical knowledge.

Several symbols have been adopted which I believe will help explain the status of many of the animals on this list. These are as follows:

?=a species reported from the state in literature, and which in all probability occurs here, but its presence needs to be firmly established.

*=a species or race introduced into Florida; breeding colonies have become established.

N*=an introduced form which may be encountered in Florida but is not known to breed in the state.

I should point out that numerous amphibians and reptiles have been reported from Florida and have never been heard of again. These are not mentioned below.

I would like to thank several people who read over an earlier form of this list. They discovered not only many taxonomic revisions of which I was unaware but also found some of my unique spellings of scientific names. To Roger Conant, Ronald Crombie, Richard Franz, John Funderburg, Herbert S. Harris Jr., Robert Tuck, and George Zug I am most thankful.

AMPHIBIA

Caudata Salamanders

?*Necturus punctatus* Gibbes.	Dwarf Waterdog
Necturus beyeri alabamensis Viosca.	Alabama Waterdog
Amphiuma means means Garden.	Two-toed Amphiuma
Amphiuma pholeter Neill.	Dwarf Amphiuma
Notophthalmus perstriatus Bishop.	Striped Newt
Notophthalmus viridescens louisianensis Wolterstorff.	Central Newt
Notophthalmus viridescens piaropicola Schwartz and Duellman.	Peninsula Newt
?*Notophthalmus viridescens viridescens* Rafinesque.	Red-spotted Newt
Ambystoma cingulatum Cope.	Flatwoods Salamander
?*Ambystoma maculatum* Shaw.	Spotted Salamander
Ambystoma opacum Gravenhorst.	Marbled Salamander
Ambystoma talpoideum Holbrook.	Mole Salamander
Ambystoma tigrinum tigrinum Green.	Eastern Tiger Salamander
Plethodon glutinosus glutinosus Green.	Slimy Salamander
Eurycea bislineata cirrigera Green.	Southern Two-lined Salamand
Eurycea longicauda guttolineata Holbrook.	Three-lined Salamander
Manculus guadridigitatus Holbrook.	Dwarf Salamander
Haideotriton wallacei Carr.	Southeastern Blind Salamand
Pseudotriton montanus floridanus Netting and Goin.	Rusty Mud Salamander
Pseudotriton montanus flavissimus Hallowell.	Gulf Coast Mud Salamander
Pseudotriton ruber vioscai Bishop.	Southern Red Salamander
Desmognathus fuscus fuscus Rafinesque.	Northern Dusky Salamander
Desmognathus fuscus auriculatus Holbrook.	Southern Dusky Salamander
Hemidactylium scutatum Schlegel.	Four-toed Salamander
Siren lacertina Linnaeus.	Greater Siren
Siren intermedia intermedia Le Conte.	Eastern Lesser Siren
Pseudobranchus striatus belli Schwartz.	Everglades Dwarf Siren
Pseudobranchus striatus axanthus Netting and Goin.	Narrow-striped Dwarf Siren
Pseudobranchus striatus lustricolus Neill.	Gulf Hammock Dwarf Siren
Pseudobarnchus striatus spheniscus Goin and Crenshaw.	Slender Dwarf Siren

Salienta Frogs and Toads

Scaphiopus holbrooki holbrooki Harlan.	Eastern Spadefoot
**Eleutherodactylus planirostris planirostris* Cope.	Greenhouse Frog
Bufo terrestris Bonnaterre.	Southern Toad
Bufo woodhousei fowleri Hinckley.	Fowler's Toad
Bufo quercicus Holbrook.	Oak Toad
**Bufo marinus* Linnaeus.	Giant Toad
Hyla crucifer crucifer Wied.	Northern Spring Peeper
Hyla crucifer bartramiana Harper.	Southern Spring Peeper

Hyla cinerea Schneider.	Green Treefrog
Hyla femoralis Latreille.	Pine-woods Treefrog
Hyla gratiosa Le Conte.	Barking Treefrog
Hyla squirella Latreille.	Squirrel Treefrog
Hyla chrysoscelis Cope.	Southern Treefrog
Hyla avivoca avivoca Viosca.	Western Bird-voiced Treefrog
**Hyla septentrionalis* Boulenger.	Cuban Treefrog
Limnaoedus ocularis Daudin.	Little Grass Frog
Gastrophryne carolinensis carolinensis Holbrook.	Eastern Narrow-mouthed Toad
Acris crepitans crepitans Baird.	Northern Cricket Frog
Acris gryllus gryllus Le Conte.	Southern Cricket Frog
Acris gryllus dorsalis Harlan.	Florida Cricket Frog
Pseudacris nigrita nigrita Le Conte.	Southern Chorus Frog
Pseudacris nigrita verrucosa Cope.	Florida Chorus Frog
Pseudacris triseriata feriarum Baird.	Upland Chorus Frog
Pseudacris ornata Holbrook.	Ornate Chorus Frog
Rana catesbeiana Shaw.	Bullfrog
Rana heckscheri Wright.	River Frog
Rana grylio Stejneger.	Pig Frog
Rana virgatipes Cope.	Carpenter Frog
Rana clamitans clamitans Latreille.	Bronz Frog
Rana pipiens sphenocephala Cope.	Southern Leopard Frog
Rana areolata aesopus Cope.	Florida Gopher Frog
Rana areolata sevosa Goin and Netting.	Dusky Gopher Frog

REPTILIA

Crocodilia Crocodilians

Alligator mississipiensis Daudin.	American Alligator
N**Caiman crocodilus fuscus* Cope.	Central American Caiman
Crocodylus acutus Cuvier.	American Crocodile

Testudinana Turtles

Chelydra serpentina serpentina Linnaeus.	Common Snapping Turtle
Chelydra osceola Stejneger.	Florida Snapping Turtle
Macrochelys temmincki Troost.	Alligator Snapping Turtle
Sternothaerus odoratus Latreille.	Stinkpot
Sternothaerus minor minor Agassiz.	Loggerhead Musk Turtle
Sternothaerus minor peltifer Smith and Glass.	Stripe-necked Musk Turtle
Kinosternon bauri bauri Garman.	Key Mud Turtle
Kinosternon bauri palmarum Stejneger.	Striped Mud Turtle
Kinosternon subrubrum subrubrum Lacepede.	Eastern Mud Turtle
Kinosternon subrubrum steindachneri Siebenrock.	Florida Mud Turtle

Kinosternon subrubrum hippocrepis Gray.	Mississippi Mud Turtle
?*Clemmys guttata* Schneider.	Spotted Turtle
Terrapene carolina carolina Linnaeus.	Eastern Box Turtle
Terrapene carolina bauri Taylor.	Florida Box Turtle
Terrapene carolina mojor Agassiz.	Gulf Coast Box Turtle
Malaclemmys terrapin centrata Latreille.	Carolina Diamondback Terrapin
Malaclemmys terrapin macrospilata Hay.	Ornate Diamondback Terrapin
Malaclemmys terrapin pileata Weid.	Mississippi Diamondback Terrapin
Malaclemmys terrappin rhizophorarum Fowler.	Mangrove Terrapin
Malaclemmys terrapin tequesta Schwartz.	Florida East Coast Terrapin
Graptemys barbouri Carr and Marchand	Barbour's Map Turtle
Graptemys pulchra Baur.	Alabama Map Turtle
Chrysemys floridana floridana Le Conte.	Florida Cooter
Chrysemys floridana peninsularsis Carr.	Peninsula Cooter
Chrysemys concinna swannensis Carr.	Suwannee Cooter
Chrysemys concinna mobilensis Holbrook.	Mobile Cooter
Chrysemys nelsoni Carr.	Florida Red-bellied Turtle
Chrysemys alabamensis Baur.	Alabama Red-bellied Turtle
Chrysemys scripta scripta Schoepf.	Yellow-bellied Turtle
Chrysemys scripta elegans Wied.	Red-eared Turtle
Deirochelys reticularia reticularia Latreille.	Northern Chicken Turtle
Deirochelys reticularia chrysea Schwartz.	Florida Chicken Turtle
Gopherus polyhemus Daudin.	Gopher Tortoise
Chelonia mydas mydas Linnaeus.	Atlantic Green Turtle
Lepidochelys kempi Garman.	Atlantic Ridley
Caretta caretta caretta Linnaeus.	Atlantic Loggerhead
Eretomochelys imbricata imbricata Linnaeus.	Atlantic Hawksbill
Dermochelys coriacea coriacea Linnaeus.	Atlantic Leatherback
Trionyx ferox Schneider.	Florida Softshell
Trionyx muticus Le Sueur.	Smooth Softshell
Trionyx spinifer asper Agassiz.	Gulf Coast Softshell

Squamata sub-order Sauria Lizards

Anolis carolinensis carolinensis Voigt.	Carolina Anole
Anolis distichus floridanus Smith and McCauley	Florida Bark Anole
**Anolis districhus dominicensis* Reinhardt and Lutken	Green Bark Anole
**Anolis equestris equestris* Merren.	Cuban Giant Anole
**Anolis sageri sageri* Cocteau.	Cuban Brown Anole
**Anolis sageri ordinatus* Cope.	Bahamian Brown Anole
Sceloporus undulatus undulatus Latreille.	Southern Fence Lizard
Sceloporus woodi Stejneger.	Florida Scrub Lizard
(N)**Phrynosoma cornutum* Harlan.	Texas Horned Lizard
N**Iguana iguana iguana* Linnaeus.	Green Iguana
N**Cyclura cornuta cornuta* Bonnaterre.	Rhinoceros Iguana
Cnemidophorus sexlineatus sexlineatus Linnaeus.	Six-lined Racerunner

N**Ameiva ameiva ameiva* Linnaeus.	South American Ground Lizard
**Amevia ameiva petersi* Cope.	Colombian Ground Lizard
**Leiocephalus carinatus armouri* Barbour and Shreve.	Bahama Curly-tailed Lizard
Sphaerodactylus notatus Baird.	Reef Gecko
**Sphaerodactylus cinereus* Wagler.	Ashy Gecko
**Sphaerodactylus argus argus* Gosse.	Ocellated Gecko
**Gonatodes albogularis fuscus* Hallowell.	Yellow-headed Gecko
**Hemidactylus turcicus turcicus* Linnaeus.	Mediterranean Gecko
**Hemidactylus garnoti* Dumeril and Bibron.	Indo-Pacific Gecko
Ophisaurus attenuatus longicaudus McConkey.	Eastern Slender Glass Lizard
Ophisaurus compressus Cope.	Island Glass Lizard
Ophisaurus ventralis Linnaeus.	Eastern Glass Lizard
Eumeces inexpectatus Taylor.	Southeastern Five-lined Skink
Eumeces fasciatus Linnaeus.	Five-lined Skink
Eumeces laticeps Schneider.	Florida Keys Mole Skink
Eumeces egregius egregius Baird.	Broad-headed Skink
Eumeces egregius onocrepis Cope.	Peninsula Mole Skink
Eumeces egregius similis McConky.	Northern Mole Skink
Eumeces egregius lividus Mount	Blue-tailed Mole Skink
Eumeces egregius insularis Mount.	Cedar Keys Mole Skink
Eumeces anthracinus pluvialis Cope.	Southern Coal Skink
Lygosoma laterale Say.	Ground Skink
Neoseps reynoldsi Stejneger.	Sand Skink
Rhineura floridana Baird.	Worm Lizard

Squamata sub-order Serpentes Snakes

Natrix cyclopion cyclopion Dumeril, Bibron and Dumeril.	Green Water Snake
Natrix cyclopion floridana Goff.	Florida Green Water Snake
Natrix erythrogaster erythrogaster Forster.	Red-bellied Water Snake
Natrix sipedon pleuralis Cope	Midland Water Snake
Natrix fasciata fasciata Linnaeus.	Banded Water Snake
Natrix fasciata pictiventris Cope	Florida Banded Water Snake
Natrix fasciata clarki Baird and Girard.	Gulf Salt Marsh Snake
Natrix fasciata compressicauda Kennicott.	Mangrove Water Snake
Natrix fasciata taeniata Cope.	Atlantic Salt Marsh Snake
Natrix rigida rigida Say.	Atlantic Glossy Water Snake
Natrix rigida sinicola Huheey.	Gulf Glossy Water Snake
Natrix septemvittata Say.	Queen Snake
Natrix taxispilota Holbrook.	Brown Water Snake
Storeria dekayi wrightorum Trapido.	Southern Brown Snake
Storeria dekayi victa Hay.	Florida Brown Snake
Storeria dekayi limnetes Anderson.	Marsh Brown Snake
Storeria occipitomaculata obscura Trapido.	Florida Red-bellied Snake
Storeria occipitomaculata occipitomaculata Storer.	Northern Red-bellied Snake
Thamnophis sirtalis sirtalis Linnaeus.	Eastern Garter Snake

Thamnophis sirtalis similis Rossman.	Gulf Hammock Garter Snake
Thamnophis sauritus sackeni Kennicott.	Southern Ribbon Snake
Thamnophis sauritus nitae Rossman.	Gulf Hammock Ribbon Snake
Virginia valeriae valeriae Baird and Girard.	Eastern Earth Snake
Virginia striatula Linnaeus.	Rough Earth Snake
Liodytes alleni Garman.	Striped Swamp Snake
Heterodon platyrhinos Latreille.	Eastern Hog-nosed Snake
Heterodon simus Linnaeus.	Southern Hog-nosed Snake
Rhadinaea flavilata Cope.	Pine Woods Snake
Diadophis punctatus puncatus Linnaeus.	Southern Ring-necked Snake
?*Carphophis amoenus amoenus* Say.	Worm Snake
Francia erytrogramma erytrogramma Latreille.	Rainbow Snake
Francia erytrogramma seminola Neill.	Okeechobee Rainbow Snake
Francia abacura abacura Holbrook.	Eastern Mud Snake
Francia abacura reinwardti Schlegel.	Western Mud Snake
Coluber constrictor paludicola Auffenberg and Babbitt.	Everglades Racer
Coluber constrictor priapus Dunn and Wood.	Southern Black Racer
Coluber constrictor helvigularis Auffenberg.	Brown-chinned Racer
Masticophis flagellum flagellum Shaw.	Eastern Coachwhip
Drymarchon corais couperi Holbrook.	Eastern Indigo Snake
Opheodrys aestivus Linnaeus.	Keeled Green Snake
Elaphe guttata guttata Linnaeus.	Corn Snake
Elaphe obsoleta quadrivittata Holbrook.	Yellow Rat Snake
Elaphe obsoleta rossalleni Neill.	Everglades Rat Snake
Elaphe obsoleta spiloides Dumeril, Bibron and Dumeril.	Gray Rat Snake
Elaphe obsoleta williamsi Barbour and Carr.	Gulf Hammock Rat Snake
Pituophis melanoleus magitus Barbour.	Florida Pine Snake
Lampropeltis triangulum elapsoides Linnaeus.	Scarlet King Snake
Lampropeltis calligaster rhombomaculata Holbrook.	Mole Snake
Lampropeltis getulus getulus Linnaeus.	Eastern King Snake
Lampropeltis getulus floridana Blanchard.	Florida King Snake
Lampropeltis getulus goini Neill and Allen.	Blotched King Snake
Stilosoma extenuatum extenuatum Brown.	Eastern Short-tailed Snake
Stilosoma extenuatum arenicolor Highton.	Western Short-tailed Snake
Stilosoma extenuatum multistictum Highton.	Northern Short-tailed Snake
Tantilla relicta relicta Telford.	Scrub Crowned Snake
Tantilla relicta neilli Telford.	Peninsular Crowned Snake
Tantilla relicta pamlica Telford.	Coastal Dune Crowned Snake
Tantilla oolitica Telford.	South Florida Crowned Snake
Tantilla coronata Baird and Girard.	Southeastern Crowned Snake
Cemophora coccinea coccinea Blumenbach.	Florida Scarlet Snake
Cemophora coccinea copei Williams and Wilson.	Eastern Scarlet Snake
Seminatrix pygaea pygaea Cope.	North Florida Swamp Snake
Seminatrix pygaea cyclas Dowling.	South Florida Swamp Snake
Micrurus fulvius fulvius Linnaeus.	Eastern Coral Snake
Agkistrodon contortrix contortrix Linnaeus.	Southern Copperhead

Agkistrodon piscivorus conanti Gloyd.	Florida Cottonmouth
Sistrurus milliarius barbouri Gloyd.	Dusky Pygmy Rattlesnake
Crotalus horridus atricaudatus Latreille.	Canebrake Rattlesnake
Crotalus adamanteus Beauvois.	Eastern Diamondback Rattlesnake

17 August 1970

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A note on the behavior of the sand skink

Neoseps reynoldsi

According to Schmidt and Inger (1957) a group of small forest dwelling teiid lizards of the genus *Echinosaura* that inhabit Panama and Colombia resort to a unique type of defensive behavior. These lizards resemble twigs in their body form and coloration and when touched hold their body absolutely rigid, presumably to increase the possibility of a predator mistaking them for a piece of forest litter. Recently, I observed similar behavior exhibited by a sand skink, *Neoseps reynoldsi*, collected near Haines City, Polk County, Florida on 1 April 1970. The specimen was taken from a pocket gopher (*Geomys*) mound in a sand hill (oak-long leaf pine) habitat. Funderburg and Lee (1968) previously mention finding *Neoseps* in similar situations.

When the skink was placed in a container holding several inches of sand it immediately burrowed beneath the surface using a characteristic swimming motion. However, when held in the hand or placed on a flat surface it held its body rigid and lay absolutely still. This behavior was noted on seven consecutive occasions that the specimen was removed from its container over a three day period. On each occasion the posture was similar. The head and tail were curved to the left, the chin elevated approximately two millimeters and twisted down on the left side, and the legs were held tightly against the body. The lizard always lay with its ventral surface down. It reacted to all efforts that were made to turn it over by quickly revolving onto its stomach again.

When again placed in the container of sand it would hold its rigid posture for a few seconds and then make several jerky forward thrusts and proceed to burrow. On the first occasion that this behavioral pattern was observed it was held for approximately fourty seconds and then the specimen executed the jerked movements mentioned above and started to crawl. On each successive occasion the duration of the rigid posture was less until, after the seventh occasion, it was no longer exhibited.

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Notes on a communial nesting site of *Sternotherus odoratus*

Communal nesting sites of the common musk turtle (*Sternotherus odoratus*) have been reported by Cagal (1937) who observed sixteen nests under a small log in Tennessee. On 8 July 1969 a cypress stump in Blue Springs Mill Pond (US 90, 2 miles east of Mariana, Jackson County, Florida) was found to contain a total of thirty nine musk turtle eggs. The stump was partially decayed and contained an accumulation of debris which supported several clumps of grass. The stump, located approximently 100 yards from shore in five feet of water, rose three feet above the water and contained three nesting sites. The nest nearest to the water surface had five eggs which were in a grassey area of the stump. The second nest was located just above the first, while the third was found on top of the stump three feet above the water. Several eggs in the lower nest were found to be broken, this may have been due to females digging up previously layed eggs. Some eggs in each nesting site were not burried, this may also be due to activities of late arriving females.

The eggs were removed and kept in jars containing moist paper towels. Hatching started in the middle of August and continued until the second week of September. This prolonged period indicates that there was a considerable interval of time during which the eggs were laid. Eight randomly selected eggs were measured which ranged from 23 mm to 28 mm (25.3) in length and 14 mm to 16 mm (14.9) in width.

Since this stump was located a considerable distance from shore it offered protection from predators and due to the large area of the pond the stump may have been more accessable to the turtles for egg laying then the immediate shore which has been deforested. Other stumps in the area were examined but did not contain eggs.

At least five additional species of turtles were known from this pond; chicken turtles (*Deirochelys reticularia*), river cooters (*Pseudemys concinna*), pond turtles (*Pseudemys scripta*), mud turtles (*Kinosternon subrubrum*), and alligator snapping turtles (*Macroclemys temmincki*). It is interesting to note that these turtles did not utilize the cypress stumps as nesting sites.

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THE BROWN KING SNAKE OR MOLE SNAKE (*LAMPROPELTIS RHOMBOMACULATA*) IN MARYLAND

by

Henry F. Howden

The first Maryland specimen of the brown king snake, *Lampropeltis rhombomaculata*, was recoraed by Charles W. Richmond in 1889 at Bladensburg, Maryland (No. 17294 U.S.N.). Several others were recorded from the District of Columbia about this time.

The general opinion seems to be that the brown king snake is very uncommon in Maryland. Fowler (1945) working on the herpetofauna of the National Capital Parks and the District of Columbia Region

listed the brown king snake as uncommon, with no records from the parks. McCauley (1945) lists 17 records from the District of Columbia and Maryland. He states that they are very uncommonly found.

However, this opinion should perhaps be revised. Cope (1898) stated that perhaps they were not as rare as it had previously been believed, as eleven of these snakes were taken in and around the District of Columbia. Later, Blanchard (1921) said that "its apparent rarity is undoubtedly due to its secretive and burrowing habits, but it is sometimes found in the open".

In the spring of 1944 there were eleven of these snakes caught within a radius of ten miles of College Park, Maryland. Nine of them were caught in the Patuxent Game Refuge. The other two I have in my possession. One was caught on the road leading into the Refuge; the other was caught on the Washington Boulevard, one-half mile north of College Park. It was on the side of the road and several boys were busy exterminating it. When the snake was rescued its back was broken and it had to be preserved. This snake had unusually light coloration, the blotches being very pronounced. This condition is usual in young snakes, but not in adult specimens.

Several of the snakes mentioned above were caught along the edges of fields which were bordered by woods. This seems to indicate that, at least in spring time, the mole snake is not as secretive as supposed. Ditmars (1907) mentioned finding a specimen in the open.

The mole snakes caught in Maryland around College Park averaged in length between two and one-half to three feet. The adults are brown in color, fading into a lighter yellow-brown along the sides. Along the back there are 50 to 65 blotches of dark brown, edged with black. The blotches are six to seven scales wide transversely and two to three scales wide along the median line of the back. There is another alternate row of blotches, much smaller and indistinct, along the sides. These blotches do not cover more than three of four scales.

In the adult snake this pattern becomes very dark, and just before shedding, the snake appears to be a uniform dark brown unless examined in a strong light. Miller (1902) described an adult of this description. The abdomen is a cream or yellowish color, irregularly spotted with reddish-brown blotches. In very young specimens the pattern is very pronounced, the blotches along the back being a bright reddish-brown. Even in some adults this pronounced pattern may be noted. Hay (1902) described a well-marked specimen.

The first mole snake that I obtained was caught on May 4, 1944, about one-half mile north of College Park on the Washington Boulevard. The day was clear and warm, the temperature being about 75 degrees F.; the time, eleven A.M. It has already been mentioned that its back had been broken by some small boys. This specimen is thirty and one-half inches long, the tail being four and

one-eighth inches long. Its greatest diameter does not exceed one-half inch. The markings on this snake were very pronounced, the blotches along the back being a brick red. The scale count around the neck is 21, in the middle of the body 21 and 23, and just before the anus 19. The ventrals number 201, the caudals, 46. The locality in which this snake was caught was fairly heavily wooded, with a sandy and gravelly soil. There was a moderate growth of underbrush with numerous fallen logs.

The second specimen was caught on May 8, 1944, about two-thirty P.M. on the edge of the road leading into the Patuxent Game Refuge. It was a clear, warm day, about eighty degrees F. On each side of the gravel road were several fields and open woods. The soil was sandy, mixed with clay, with several small streams nearby. This was the type of location in which many of the mole snakes were caught.

The specimen, which remained alive and in good condition until February, 1945, when it was preserved, was 45 inches long. The scale count at the neck was 21, in the middle of the body 22, and just before the anus 21. The number of ventrals was 199, of caudals, 46. The snake shed one week after being caught, again on August 9, 1944, and then on September 20th. After the third shedding the snake had increased five-sixteenth of an inch in length since the day it was caught.

During the summer, this mole snake consumed two mice a week on the average. Lizards were put in the cage but this snake seemed to prefer mice. It even fed just before shedding. The snake quickly became very tame, and fed while being handled. This seemed unusual for, from all reports, the mole snake is a morose captive. Blanchard (1921) stated that "generally speaking these snakes are sluggish captives and uninteresting in captivity".

The method of feeding is usually by constriction. However, at times, the specimen mentioned would seize a mouse by its head and kill it by wedging the mouse in a corner of the cage with a coil, pressing it to death. Many times this did not work and the snake would resort to constriction. When dead the mouse was seized by the head and gradually swallowed. The entire process took from thirty minutes to an hour. Toward the end of September this snake began to feed at more irregular intervals and not as readily as before. This perhaps was due to the change in the weather and the tendency of the snake to hibernate, as the specimen remained in good condition until February, 1945, when it was preserved.

Little is yet known about the breeding habits and natural food of this interesting species of snake. However, Groves (1943) obtained a Maryland specimen 41 inches in length, near the District of Columbia, which laid 15 eggs on July 11th, 1936. Unfortunately, the eggs did not hatch.

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Reprinted from Maryland, XVI (2): 38-40, with permission of the Natural History Society of Maryland, Inc. Ed. note: For current data on distribution see "Distributional Survey: Maryland and the District of Columbia", Bull. Md. Herp. Soc. *5* (4) :97-161.

NOTES ON *CEMOPHORA COCCINEA* (BLUMENBACH) IN MARYLAND AND THE DISTRICT OF COLUMBIA VICINITY.

Stejneger (1905, Proc. Biol. Soc. Wash. 18: 73) added the Scarlet Snake, *Cemophora coccinea* (Blumenbach) to the list of snakes known to occur in the District of Columbia. The basis for this addition was a specimen in the United States National Museum (No. 35308) collected in 1893 in the vicinity of Anacositia. Previously, in 1862, Prof. A. Wyatt collected this snake from Baltimore, Maryland. This specimen is now No. 750 in the Museum of Comparative Zoology at Harvard College. This was apparently the initial Maryland record for this snake. Another early Maryland record for this species was collected at St. Margarets, Anne Arundel Co., in 1891. Cope (1900, Ann. Rept. U. S. Nat. Mus. 1898, p. 903) mentions this specimen which was sent to the Museum but which later escaped.

The present paper lists the subsequent records for *C. coccinea* from Maryland and the District of Columbia vicinity, together with comments on its distribution. These notes were prompted by the recent discovery of another Scarlet Snake in the local region. This new specimen was made available to the writer through the efforts and cooperation of Mr. D. W. Willingmyre and Dr. Martin H. Muma. These subsequent records are as follows:

MARYLAND:

Wicomico Co., Salisbury; collected by J. P. Brown, April 5, 1923 (Univ. of Md. No. 1).

Prince Georges Co., Brandywine (McCauley, 1940, unpublished PhD. thesis, Cornell Univ.---on the basis of a photograph in the possession of C. S. East).

This snake has also been reported from Severn, Anne Arundel Co., and St. Denis, Baltimore Co., by Kelley, Davis, and Robertson (1936, Snakes of Maryland, p. 68).

VIRGINIA:

Fairfax Co., Mt. Vernon (Dunn, 1936, List of Virginia Amphibians and Reptiles, Haverford, Pa., mimeographed, p. 5). This specimen is now in the University of Michigan Museum of Zoology (No. 56260).

The recently discovered specimen, which prompted this report, was collected in the basement of a house at Lanham, Prince Georges Co., Maryland, on September 13, 1944. It measured 14 inches in length, while the average for this species is 16 inches (Conant and Bridges, 1939. What Snake Is That?, p. 85).

Thus from the time that the initial specimen of *C. coccinea* was collected from Maryland in 1862 to the present, this snake has only been recorded on nine different occasions. The apparent scarcity of this species is probably correlated both with its secretive habits and with its greater abundance in the more southern parts of its range. In this latter connection it is of interest to note that the specimens mentioned by Stejneger (loc. cit.) from the District of Columbia and Maryland were at that time the most northern records for this essentially southern snake. Since that time, however, the range of this snake has been extended to New Jersey (Kauffeld, 1935, Copeia, No. 4, p. 191). The present distribution, as given by Stejneger and Barbour (1943, Check List of North American Amphibians and Reptiles, 5th Ed., p. 152), is thus from southern New Jersey to Alabama, Louisiana, Oklahoma, and Florida.

So far as the distribution of *C. coccinea* in the New Jersey, Maryland, and District of Columbia portion of its range is concerned, all of the localities are, with one exception, in the Coastal Plain. The single exception is the specimen collected from Baltimore in 1862 for which there is not sufficient data to determine its exact physiographic affinity. In Virginia, on the other hand, although most of the material is also from the Coastal Plain, there are a few records for the occurrence of this snake in the Piedmont Plateau and one record from west of the Blue Ridge in the Valley and Ridge Province.

The apparent limitation of *C. coccinea* to the Coastal Plain in New Jersey, Maryland, and the District of Columbia, as compared with its more widespread occurrence in Virginia and other parts of its range, is of considerable interest. This type of distribution is thus shown by other southern species of both amphibians and reptiles which, as they extend their ranges northward, tend to become associated with the Coastal Plain. Moreover, such species usually occur no farther north than either Maryland or New Jersey in the eastern United States. Some of these species, and the State in which they reach their northernmost distribution, are as follows: *Gastrophryne carolinensis* (Md.), *Cnemidophorus sexlineatus* (Md.), *Leiolopisma unicolor* (N. J.), *Elaphe guttata* (N. J.), *Pituophis m. melanoleucus* (Rockland Co., N. Y.), and *Lampropeltis g. getulus* (N. J.).

J. A. Fowler.

Reprinted from the Proc. Bio. Soc. Wash., *58* :89-90. Ed. Note: for current data on distribution see Bull. Md. Herp. Soc., *5*(4): 97-161.

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